DEVELOPMENT OF PRODUCTION RATES DATABASE FOR CIVIL WORKS OF SUBSTRUCTURE ACTIVITIES

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By

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the requirements for the
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(Civil Engineering)

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CERTIFICATION OF APPROVAL

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Approved by,

(Assoc. Prof. Ir Dr Arazi Idrus)
Project Supervisor

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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

MUHAMAD NAZIM BIN MOHAMAD NAWI

ABSTRACT

Production rate (also known as construction or productivity rate) is one of the important data needed for determining activity duration and hence for scheduling of the activities in a project. However, because production rates are greatly affected by various controlled and uncontrolled factors, there are some calculations can be derived to evaluate them but none of them is conclusive. Because of this, their values have all been based on the experience and judgment of the individual construction manager, as well as from previous company records. These values are often subjective and also not freely available to others outside the company. The aim of this paper is to report on the pioneering work at UTP to develop a formal database of "moderated" production rates for in-situ civil and structural construction works, which will not only be reliable but also accessible to everyone in the industry. The Direct Observation Methodology has been used in this research to elicit data on production rates. For this, data were collected at the site using stopwatch and also video recording while directly observing the activities were done. Data collected were compiled and analyzed using descriptive statistics and variance analysis. It was found that the observation had produced a reliable production rate values for each activity. As the study is one of the pioneering works to be conducted in Malaysia, the results obtained may not yet be taken as final or universally accepted for use by the construction industry. However, it does provide an indication of production rates data in the industry. Strengthen with statistical analysis done, this research has meet all of its objectives and the production rates compiled can be used as for database of substructure activity. It is useful as a reference to academia and also can be used in industry field.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND STUDY

Construction is among the world's largest and most challenging industry. Construction projects are increasingly complex. In spite of its complexities, construction is a systematic industry. In short, construction is a dynamic industry and one that we can look to with a great deal of pride.

Nonetheless, our industry has experienced problems in recent years. Construction costs have risen at a rate approximately 50% higher than the inflation rate. Project durations have increased and many projects have overrun their projected schedules[1].

The design and execution of the project must consider a lot of matters such as budgeting, successful scheduling, site safety, environmental impact of the job, availability of materials, logistics, and inconvenience to the public by construction delays. Hence, an effective planning is very crucial for the successful execution of overall project. The construction job normally is managed by the project manager and supervised by the construction manager, design engineer, project engineer or project architect[2].

In general, there are types of construction which are building construction, heavy/civil construction, and industrial construction. Building construction is the process of adding structure to real property. The vast majority of building construction projects is small renovations, such as addition of a room, or renovation of a bathroom. Often, the owner of the property acts as laborer, paymaster, and design team for the entire project. However, all building construction projects include some elements in common which

are design, financial, and legal considerations. Many projects of varying sizes reach undesirable end results, such as structural collapse, cost overruns, and/or litigation reason, those with experience in the field make detailed plans and maintain careful oversight during the project to ensure a positive outcome[2] .

Building construction is procured privately or publicly utilizing various delivery methodologies, including hard bid, negotiated price, traditional, management contracting, construction management-at-risk, design & build and design-build bridging [2]. Productivity of a construction project will be determined from the activity duration of the construction works done at site.

1.2 PROBLEM STATEMENT

In construction field, information on activity duration is essential in scheduling construction activities on site, in costing the activities or in predicting overall project completion time. Production rates is computed by dividing the quantity of work involved with the number of resources used and the corresponding activity duration (e.g. m^3 of concrete poured per hour, tones of steel reinforcement laid per hour, m^2 of formwork installed per hour, etc.).

Thus:

$$\text{Production Rates (R)} = \frac{\textit{Quantity of work (Q)}}{\textit{Activity duration (T)} \times \textit{No. of resources (N)}}$$

Quantity of work and number of resources (people or machine) can be quantitatively determined. However, because production rates are greatly affected by various controlled and uncontrolled factors, no conclusive calculation can be derived to evaluate them. Because of this, their values have all been based on the experience and judgment of the individual construction manager, as well as from previous company records. These values are often subjective and also not freely available to others outside the company.

There is therefore a need to elicit and compile such information from the industry, analyze to develop a formal database of "moderated" production rates, which is not only reliable but also accessible by everyone in the industry.

There is no such research by using direct observation for collecting data from construction site. A previous research done in UTP has focused on the collection of production rates data for structural works of a building project from industry experts by questionnaire survey.

To improvise the previous method in determining activity duration, direct observation for substructure works will be carried out based on the specific methodology that will be discussed later. Previously, there is no detail in using direct observation as method in collecting data for overall activities in substructure works. Current study collected data through questionnaire, site interviews, site visits, and telephone calls to contractors and consultants who are specialists in concrete bored pile construction and design, respectively [3].

1.3 PROJECT OBJECTIVES

This project aims to measure and assess the productivity for sub-structural work processes by direct observation method on building site construction. The aims will lead to provide useful, (near) real-time information about the process and enable more efficient, safe completion of the work scope so that fewer labor-hours will be expended. Hence, the overall objectives of the research are;

1. To collect data on production rates from the construction site by direct observation
2. To analyze data collected using statistics
3. To compile all the production rates as for database development

During measurement, consistent application of sampling from direct observation over a period of time provides project managers ongoing information about the effectiveness of actions taken to continuously improve the work process. Properly applied, it is effective in getting more construction or maintenance work done with fewer labor-hours, and with greater worker safety and satisfaction.

1.4 SCOPE OF STUDY

The whole project would start with the knowledge gathering and theoretical studies. First of all, understanding the basic theory on construction productivity and direct observation method for collecting data are very important. Paper works, journals, engineering books or anything relevant to the project are reviewed. The review on the literature relevant to the research topic is important to know this study relates to the information already available and how the finding relates to this project. After understanding the concept and methodology, direct observation can be done at site. Data collected will be analyzed by using statistic for database. Then from the analysis, the final production rates later will be determined and compiled to be accepted as database as part of developing production rates database under substructure activities.

Hence, the author optimist that feasibility of this project within the Scope and Time Frame had been enough covered and completed in the two semester final year study.

CHAPTER 2

LITERATURE REVIEW

2.1 DEFINITION OF PRODUCTIVITY

Back in 1986, the researchers [4] stated that no standardized productivity definition had been established in the construction industry. It is difficult to define a standard productivity measure because companies use their internal systems which are not standardized.

Productivity can be simply illustrated by an association between an output and an input. Two forms of productivity were used in previous studies: (1) productivity = output/input and (2) productivity = input/output. The second form has been widely used and existing in literature over the years in the construction industry. Therefore, this research adopted the second form to maintain consistency with other productivity research in construction and CII benchmarking and metrics (BM&M) performance indices like cost growth and schedule growth in which a lower value represents better performance.

Labor productivity is measured in actual work hours per installed quantity; that is, the number of actual work hours required to perform the appropriate units of work and as noted, when defined in this manner, lower productivity values indicate better productivity performance [5].

To be more specific related to this research, the definition of ***productivity*** is the measurement of production rates level of productiveness.

2.2 PRODUCTIVITY MEASUREMENT IN CONSTRUCTION

Researchers have concluded that it is difficult to obtain a standard method to measure construction labor productivity because of project complexity and the unique characteristics of construction projects [6]. The uniqueness and non-repetitive operations of construction projects make it difficult to develop a standard productivity definition and measure [7]. A few researches have attempted to develop common definitions and a standard productivity system; however, those were not based on the consensus of academia and industry.

As researchers [8] determined, productivity measurement is not a one-time task. Continuous measurement and comparison with other projects or companies are the keys to productivity improvement. Researcher stressed the importance of a standardized productivity data collection system to provide reliable analyses.

Besides, other researchers [9] stated that the productivity measurement research studies mentioned above have focused on how to report, measure, control, evaluate, and improve construction productivity. Yet, those studies lack a common set of definitions of activities and a standard data collection method. Furthermore, the existing productivity measurement systems have focused on micro-level activities to manage daily or monthly productivity during construction and that are tied to a sophisticated cost control system that is too complex to track and evaluate construction productivity.

2.3 CONSTRUCTION PRODUCTIVITY IMPROVEMENT

Researcher [10] stated that construction productivity has been on the decline in the last decade. The results are presented on a survey of the Engineering News-Record 400 largest contractors to obtain their views on where productivity improvements would most help and to compare the trends with a similar survey carried out in 1979. Data were collected on the general company characteristics of the responding contractors and on the contractors' opinion on potential areas for productivity improvement in the office and in the field. Findings indicate that immediate research should concentrate on

improving marketing practices, planning and scheduling, labor-management relations, site supervision, industrialized building systems, equipment policy and engineering design; and those governmental regulations have lost the immediate urgency attached to them in 1979. It is also recommended that similar surveys be conducted every 3 to 4 years to identify new trends and to steer research in the appropriate direction.

2.4 COLLECTION OF LABOR DATA

Literature review reveals that there were some previous efforts to automate collection of labor data, including:

1. Construction companies, which have recently begun to utilize new data collection technologies, presented their developments in a conference called Automated Data Collection in Construction (ADCIC) 2000.
2. A conceptual model using Radio Frequency Identification (RFID) technology. According to their concept, the worker's arrival on site and movement between tasks are recorded automatically using RFID technology, but the worker has to record the cost code of the various activities in which he/she was engaged, using a hand-held computer [11].
3. A system for labor inputs and materials tracking system comprised of three modules: (i) a database, which includes the project's plans, (ii) data collection using barcodes and manual inputting and (iii) an analysis module [12].
4. The British Research Establishment has presented another approach to labor inputs measurement, using a full time observer(s) and a hand-held computer. This measurement technique uses a human observer(s) who tours the site at regular time intervals and records tasks being undertake.

CHAPTER 3

METHODOLOGY

A methodology shows how research questions are articulated with questions asked in the field [13]. For this research project, the author has summarized the methodology in the below flow chart:

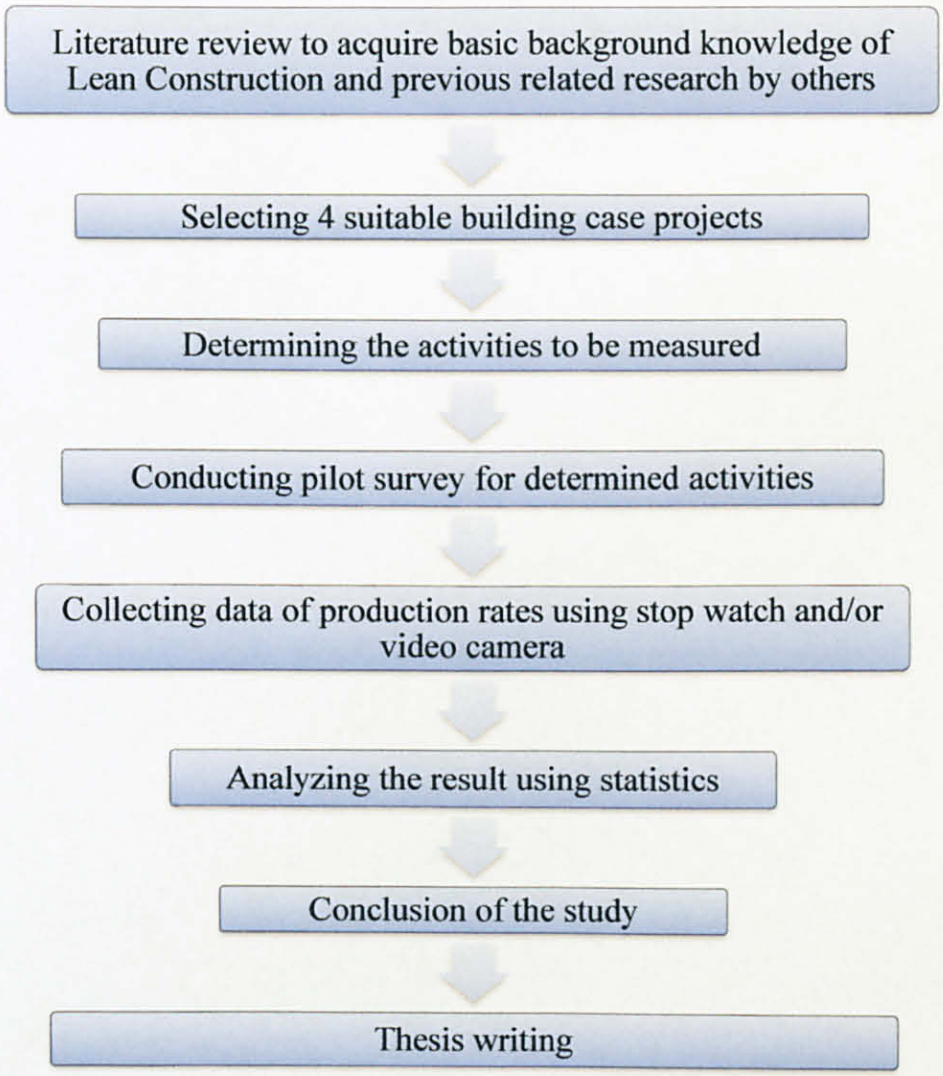

Figure 1 : Methodology Flow Chart

3.1 DIRECT OBSERVATION BACKGROUND

Method used for this research methodology is based on direct observation. Researcher used several data collection method for gathering quantitative and qualitative information such as surveys, interviews, case studies, observation, published sources to analyze particular research problems. Method of directly observing the field to gather the information both qualitative and quantitative considered more reliable and actual. Experimental and non-experimental researchers used this method to get more valid and unbiased data [14].

From literature review [15], it is defined that observation studies as those that 'involve the systematic recording of observable phenomena or behavior in a natural setting'. Direct observation is the most difficult and exhausting method of data collection requires a lot of concentration and attentiveness. Researcher has to remain focus to gather the relevant information without getting distracted [14]. It requires careful understanding and knowledge of the research problems and ability to observe originally the significant spots of an event. It is considered as more reliable approach of gathering the information as compare to interviews and other research methods because it observes the people to verify they perform their activities and behave in a same manner as they have described [16].

3.2 DIFFERENT APPROACHES OF OBSERVATIONAL RESEARCH

There are different methods to design an observational research some includes [15]:

- **Descriptive observational record**

  It includes observing and recording each and every situation or an event which happened during the observed sessions. Although it provides very detail and rich information about the event but it is very difficult to interpret and analyzed the gathered information.

- **Rating scale**

  It is another method used commonly in which the observer rate the factors observed during the session according to their frequency of occurrence and quality. Rating scale may include high inference and low inference. In high inference the observer is allowed to make a decision and judgment about the observation where as in low inference the observer only asked to count the behavior, events or factors. Therefore for the rating scale it is recommended to use high inference for the research questions being observed that provides more reliable and clear results.

- **Time sampling**

  It is used as a method of observation in which a particular time interval of an event has been observed to gather the required information. Sufficient large samples of the time intervals are required to ensure the results obtained are unbiased and accurate.

3.3 DATA GATHERING TECHNIQUES

Various types of data gathering techniques in the field have been introduced by the researchers. Selection of the techniques depends on the purpose, complexity and budget of a particular research study. The observer should identify which type of data is to be collected from the specific event or project before selecting the data gathering technique. Some of the techniques are as follows [17]:

- **Field Notes**

Field notes is an important data gathering technique used to observe and gather the data in the field. It constitutes of time, location, duration, description and follow up of an event or an activity observed by the researcher. Field notes should be recorded on a daily basis immediately as the data gathered to maintain the validity and authenticity.

- **Structured Observation**

Structured observation is another technique used to observe and gather the data in the field. It usually involves collecting quantitative information in a predesigned Perfoma of the particular activity. It is the most reliable method and collects the information independently without involving the participants. However the researcher requires being present there in the field and absences of the contextual information are the problems associated with this approach.

- **Coding Schedules**

Coding schedules is another approach used for collecting information. In coding schedule the information is recorded by assigning codes to the intervals of time periods in which an event occurs. Data usually gathered according to the specific interval of time. Codes can also assign to an events and information collected by recording the codes of an events and analyzed the frequency of each and every event that occurs during an observation session.

- **Video Recording**

The information needed to be gathered during observation can be recorded using video camera. Video camera helps in gathering the information without interference with greater accuracy. The contextual information can easily be observed and recorded by the video camera. Although the problem of large memory space to store the observation, technical issues and increase in expenses of research budget are associated with this technique but still researchers used this method for conducting valid and reliable research.

3.4 PROJECT ACTIVITIES

As per shown in the earlier stage of methodology flow chart, the first four steps which are interpret literature review, selecting 4 suitable building case projects, determining the substructure activities to be measured and doing pilot survey has been done by author in the first 4 months of research. Among the first four activities in the methodology, the most critical activity is conducting pilot survey. The main objective of doing pilot survey is to determine the reliability of the activities that had been prepared by the author. It is because the listed activities may not be applicable at particular site. The overall direct observation will depend on the activities identified and listed in the production rate form. For the task, the author needs to conduct an interview session with every representative from each identified locations.

In the initial stage of this research, the author faced up a few problems that gave a few findings and affected overall substructure activities that had been determined earlier. The problems identified and experienced by the author during the pilot survey done, are shown below:

- For each project, the pilot survey is needed to finalize the activities that are reliable to the production rate measured
- Different projects that practice different substructure activities such as different type of piling method, will lead to different cycle of activities that need to be observed and measured
- Different projects need specific production rate form
- The observant need to be at the site at least for a complete cycle of main sub-activity of substructure activities
- Without proper planning, the observant may missed the critical substructure activity
- The standard construction guidelines depend on the area of the construction. For example, all projects in the area of Dewan Bandaraya Kuala Lumpur (DBKL), need to use bore pile as the piling method.

3.5 KEY MILESTONE & GANTT CHART

The author also needs to ensure that the all important dates in completing this project can be achieved. Key milestones and Gannt Chart of this project is attached in the Appendix A and B.

3.6 EQUIPMENT & TOOLS

Below is the list of software and hardware tools required to do this research:

Software Tools	Description
Microsoft Word 2007	To prepare documentation
Microsoft Excel 2007	To prepare production rate database form and prepare statistic for analysis
Microsoft Movie Maker	To combine all the video in 1 time line for 1 cycle activity

Table 1 : List of software tools

Stop watch	To record time used to for each activity
Digital camera	To capture required photos at the site
Video camera	To record video during direct observation

Table 2 : List of hardware tools

CHAPTER 4

RESULTS

4.1 GENERAL INFORMATION

4.1.1 Site Location

The purpose of doing direct observation at different states of site location is to distinguish whether there is any significance difference in the three states with regard to substructure activities of civil works. The findings will be discussed later in Discussion chapter. The details for each project are attached in the Appendices. Table 3 and Figure 2 below show about the location of construction site from different states.

Table 3 : Site Location at Different States

State	Number of Sites
Kelantan	1
Perak	1
Selangor	2

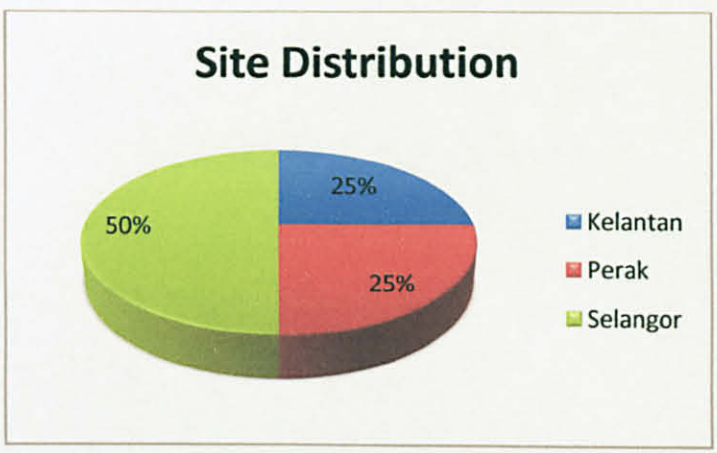

Figure 2 : Site Distribution in Different States

4.1.2 Coordinators' Designation

In doing direct observation, having a good communication with coordinator of the site will help the author in the process of collecting data during the direct observation is done. The author had liaised with the important person that is directly involve in the 4 project and always at the site during the activities were done. Table 4 below shows the coordinators' designation.

Table 4 : Coordinator's Designation

Coordinator's Designation	Number of Coordinator
Project Engineer	1
Site Supervisor	3

4.1.3 Types of Building

There are 4 projects selected to be observed by direct observation method. Among the four projects, 3 of them are education buildings and another one is commercial building. However, all of the projects are constructed by Jabatan Kerja Raya (JKR) at respective states, and the private contractor had been appointed by JKR as the constructer of their project. Every appointed contractor must follow all the standards that had been set by JKR under Sistem Pengurusan Kualiti (SPK-JKR) of implementing MS ISO 9001-2000 [18]. Meaning that, all projects use the same standard and approach to do all the activities in construction works. The production rates of activities should not be too much different if they follow all the standards as per instructed. The author will discuss more on this in Discussion part later.

4.2 DATA ANALYSIS

4.2.1 Production Rates : Presentation of Raw Data

The production rates data collected from the direct observation are presented as raw data, in tabulated form in Table 5 and Table 6 (*please refer to page 18 and 20, respectively*). All the data are divided into two main tables, which are filled by two sites for one table. The analysis for the production rates will be based on the raw data presented. Generally, there are 24 sets of data obtained from direct observation of 20 substructure activities. Meanwhile for Piling Activity, the author needs to divide based on its respective piling type. It is because the activities involved in each type of piling are not same. They need to be put in their own group of activities. After all, there are 18 sets of production rates for Piling Spun Pile and 6 sets of production rates for Piling Micro Pile. "Average Depth" in the tabulated table of raw data actually is not part of piling activities but it is still presented there because the importance of knowing the average depth in doing analysis later.

4.2.2 Production Rates : Analysis

For production rates analysis, descriptive statistics are used to describe the basic features of the data in this study [18]. The author decided to use descriptive analysis because with descriptive statistics it is simply describing what is or what the data shows. The *mean* or average is used as a method of describing central tendency. Instead of using parametric inferential statistics, descriptive analysis is used to analyze the data which also include Mean & Variance Analysis and Mode Analysis. The variance is a measure of the amount of variation within the values of that variable, taking account of all possible values and their probabilities or weightings. Mean & Variance Analysis discusses the mean and variance values on each activity which is calculated from the raw data.

At the early stage of doing analysis by activity, the author observed a large value of variance for "Piling Spun Pile" activity. Even though the sets of data collected from

the same type of piling activity, but the variance is still high. Meaning that, the piling activity of the same type needs to be categorized based on type of soil. Instead of having large value of variance, the variance is now in small value and it shows that the final production rates can be taken from mean value.

The analysis for mode *mode* and *median* is shown below in the Table 7 (*please refer to page 22).*

More on this, with regard to *mean* and *variance* values shown in Table 8 (*please refer to page 23*), it is obvious that "Excavation" activity shows a large value of variance. Thus, the *mean* cannot be accepted as the measure of central tendency for that activity. For "Checking Increment" activity, it also shows a quite large of variation value. So the production rates also cannot be taken from *mean* value. However, for the activity there are some values that occur more often in the raw data, thus the *mode* of the data was used instead taken to represent the average data. Excluding of the two activities that have large value of variance, all activities show a small value of variance. Meaning that, the *mean* value for those activities can be accepted as the final production rates.

Besides, one of the major factors affecting production rates is the gang size of the worker during the activities are done. Due to that, the author has classified the numbers of worker into 4 types of gang size. Type A for 1-2 workers of gang size, type B for 3-4 workers, type C for 5-6 workers, and type D for 7-8 workers. Hence, the final production rates presented are the outcome of collected data with regard to the type of gang size of workers during direct observation was done. The types of gang size with regard to each activity of substructure activities are shown in the Table 9 (*please refer to page 24*).

After doing statistical analysis of descriptive analysis, the database for final production rates for each substructure activities is presented in Table 10 (*please refer to page 25*).

Table 5 : Raw Data of Production Rates from Kota Bharu & Ipoh's Site

Activty/Task	Unit	Production rates											
		Kota Bharu						Ipoh					
		1	2	3	4	5	6	7	8	9	10	11	12
Piling Spun Pile													
a)Pile Driven	m/hour	56.5	55.5	50.5	54.5	52.5	55.5	19.5	20.5	17.5	21.5	19.5	18.5
b)Average Depth	m	45	44.2	43.4	45	45.2	44.8	12	12.3	12.4	12.4	12	12.5
c)Pile Cutting	point/hour	7	7	6	7	6	7	3	4	3	3	4	4
Piling Micro Pile													
a)Boring	hour	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
b)Clean up base	hour	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
c)Measuring, cutting & fabricate reinforcement cage	m/hour	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
d)Install reinforcement cage	m/hour	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pile Testing													
a)Set up	hour	12	N/A	N/A	N/A	N/A	N/A	16	N/A	N/A	N/A	N/A	N/A
b)Checking increment	hour	48	N/A	N/A	N/A	N/A	N/A	48	N/A	N/A	N/A	N/A	N/A
Excavation	m^3/hr	45	46	50	55	53	57	20	24	22	26	23	20
Formwork													
a)Size measurement, cutting & fabrication	m^2/hour	14.8	14.8	15.2	14.9	14.1	15.5	14.3	14.8	15.7	14.9	14.3	15.2

Reinforcement													
a)Size measurement, cutting & fabrication	ton/hour	0.51	0.58	0.63	0.54	0.57	0.61	0.54	0.46	0.62	0.54	0.55	0.64
Stump													
a)Installing formwork	m^2/hour	8.1	9.2	8.5	8.2	8.8	8.3	8.3	9.2	8.1	7.5	8.7	8.3
b)Concrete placement	m^3/hour	5.5	4.8	5.8	5.2	4.5	5.3	5.2	4.8	5.8	5.4	4.5	5.1
c)Dismantle Formwork	m^2/hour	15.6	14.7	15.3	15.8	14.9	16.2	14.8	15.2	15.4	15.1	14.5	14.6
Pile Cap													
a)Installing formwork	m^2/hour	5.8	6.2	5.7	5.2	5.4	5.9	5.2	6.4	5.6	5.3	5.5	5.7
b)Installing reinforcement	ton/hour	0.44	0.45	0.43	0.47	0.44	0.46	0.42	0.46	0.47	0.44	0.44	0.41
c)Concrete Works	m^3/hour	8.67	8.22	8.83	8.92	8.31	8.67	8.52	8.26	8.94	8.92	8.31	8.67
d)Dismantle Formwork	m^2/hour	10.8	11.4	10.6	10.9	11.2	11.5	10.5	11.5	10.2	10.4	10.9	11.2
Ground Beam													
a)Installing formwork	m^3/hour	9.8	9.2	10.4	9.7	9.8	9.3	9.2	9.5	10.1	9.6	9.3	9.8
b)Installing reinforcement	m^2/hour	0.48	0.47	0.51	0.44	0.46	0.42	0.43	0.46	0.51	0.46	0.48	0.41
c)Concrete Placement	ton/hour	7.61	8.22	7.75	7.56	8.34	7.52	8.24	7.61	7.75	7.58	8.34	7.62
d)Dismantle Formwork	m^3/hour	23	19	21	20	20	22	19	21	22	22	20	20
Ground Slab													
a)Installing formwork	m^2/hour	14	14.6	15.7	14.7	15.9	14.2	14	14.6	14.4	15.2	15.9	15.6
b)Installing BRC	m^2/hour	17.2	16.8	17.5	15.8	16.6	17.2	17.6	16.3	15.9	17.5	17.4	16.7
c)Concrete Placement	m^3/hour	13.2	14.5	13.8	14.1	13.7	14.3	12.9	13.7	13.8	14.2	13.9	14.3
d)Dismantle Formwork	m^2/hour	24	23	24	24	21	23	21	23	22	24	21	22

Table 6 : Raw Data of Production Rates from Ipoh & Petaling Jaya's Site

Activty/Task	Unit	Production rates											
		Shah Alam						Petaling Jaya					
		13	14	15	16	17	18	19	20	21	22	23	24
Piling Spun Pile													
a)Pile Driven	m/hour	17.5	16.5	17.5	18.5	21.5	21.5	N/A	N/A	N/A	N/A	N/A	N/A
b)Average Depth	m	23.6	23.8	23.7	23.2	21.6	23.7	26	26	26	26	26	26
c)Pile Cutting	point/hour	8	7	7	7	8	8	N/A	N/A	N/A	N/A	N/A	N/A
Piling Micro Pile													
a)Boring	hour	N/A	N/A	N/A	N/A	N/A	N/A	6	5.8	6	5.7	6.2	6
b)Clean up base	hour	N/A	N/A	N/A	N/A	N/A	N/A	0.5	0.6	0.6	0.5	0.7	0.5
c)Measuring, cutting & fabricate reinforcement cage	m/hour	N/A	N/A	N/A	N/A	N/A	N/A	3	3.4	3.1	3	3	3.3
d)Install reinforcement cage	m/hour	N/A	N/A	N/A	N/A	N/A	N/A	12	12.4	12.1	12	12.9	11.8
Pile Testing													
a)Set up	hour	14	N/A	N/A	N/A	N/A	N/A	14	N/A	N/A	N/A	N/A	N/A
b)Checking increment	hour	43	N/A	N/A	N/A	N/A	N/A	36	N/A	N/A	N/A	N/A	N/A
Excavation	m^3/hr	30	34	45	42	42	47	42	35	38	39	44	46
Formwork													
a)Size measurement, cutting & fabrication	m^2/hour	15.6	14.2	14.5	15.8	14.9	15.3	15.1	14.9	14.2	15.3	14.7	15.3

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Reinforcement													
a)Size measurement, cutting & fabrication	ton/hour	0.62	0.57	0.66	0.64	0.67	0.59	0.65	0.52	0.63	0.66	0.62	0.57
Stump													
a)Installing formwork	m^2/hour	8.7	9.5	9.4	10.1	9.6	8.8	8.1	9.4	9.2	9.5	9.7	8.2
b)Concrete placement	m^3/hour	5.7	4.9	5.3	5.4	5.9	4.6	5.6	4.7	5.5	5.7	5.5	4.9
c)Dismantle Formwork	m^2/hour	19.2	18.5	17.4	17.5	18.3	17.9	17.2	16.5	17.4	16.5	17.3	17.1
Pile Cap													
a)Installing formwork	m^2/hour	7.38	3.75	7.06	5.58	5.58	5.68	4.61	3.86	4.22	4.75	3.97	4.12
b)Installing reinforcement	ton/hour	0.46	0.47	0.47	0.42	0.45	0.44	0.48	0.47	0.44	0.45	0.45	0.41
c)Concrete Works	m^3/hour	8.33	9.12	9.4	8.85	9.11	8.92	8.45	9.12	9.2	8.73	9.11	8.54
d)Dismantle Formwork	m^2/hour	11.2	10.7	10.5	11.3	10.4	10.8	10.7	10.5	11.2	10.8	10.7	11.2
Ground Beam													
a)Installing formwork	m^3/hour	10	9.8	11.2	11.5	10.6	10.4	9.3	9.7	10.4	10.7	9.5	10.4
b)Installing reinforcement	m^2/hour	0.62	0.57	0.66	0.59	0.61	0.67	0.48	0.55	0.54	0.57	0.49	0.53
c)Concrete Placement	ton/hour	8.52	8.94	9.23	8.45	9.42	8.92	8.72	8.84	9.29	8.45	9.22	8.96
d)Dismantle Formwork	m^3/hour	22	19	21	22	20	20	20	19	22	21	21	22
Ground Slab													
a)Installing formwork	m^2/hour	14.8	15	15.7	15.2	15.4	14.9	14.8	15.2	15.7	14.9	14.3	15.4
b)Installing BRC	m^2/hour	16.8	17.2	17.4	16.8	17.3	17.4	17.3	17.5	16.8	17.2	16.6	17.1
c)Concrete Placement	m^3/hour	13.2	13.6	13.4	13.1	14.5	13.9	13.2	13.6	13.4	13.1	14.5	13.9
d)Dismantle Formwork	m^2/hour	23	20	21	21	22	23	23	23	20	21	20	21

Table 7 : Analysis on mode and median of raw data

Activty/Task	Unit	Mode	Median
Excavation	m^3/hr	42	42
Formwork			
a)Size measurement, cutting & fabrication	m^2/hour	14.9	14.9
Reinforcement			
a)Size measurement, cutting & fabrication	ton/hour	0.54	0.6
Stump			
a)Installing formwork	m^2/hour	8.1	8.75
b)Concrete placement	m^3/hour	5.5	5.3
c)Dismantle Formwork	m^2/hour	17.4	16.35
Pile Cap			
a)Installing formwork	m^2/hour	5.7	5.54
b)Installing reinforcement	ton/hour	0.44	0.45
c)Concrete Works	m^3/hour	8.67	8.78
d)Dismantle Formwork	m^2/hour	11.2	10.8
Ground Beam			
a)Installing formwork	m^3/hour	9.8	9.8
b)Installing reinforcement	m^2/hour	0.48	0.5
c)Concrete Placement	ton/hour	7.61	8.395
d)Dismantle Formwork	m^3/hour	20	21
Ground Slab			
a)Installing formwork	m^2/hour	15.7	14.95
b)Installing BRC	m^2/hour	17.2	17.2
c)Concrete Placement	m^3/hour	13.2	13.75
d)Dismantle Formwork	m^2/hour	23	22

Table 8 : Overall analysis by activities for mean and variance

Activty/Task	Unit	Analysis by Activities	
		Mean	Variance
Piling Spun Pile : Fine Grained Soil	Bearing capacity : < 75 kN/m^2		
a)Pile Driven	m/hour	54.18	5.05
b)Average Depth	m	44.60	0.46
c)Pile Cutting	point/hour	6.67	0.27
Piling Spun Pile : Coarse Grained Soil	Bearing capacity : 75 to 150 kN/m^2		
a)Pile Driven	m/hour	19.17	3.15
b)Average Depth	m	17.77	33.34
c)Pile Cutting	point/hour	5.50	4.64
Piling Micro Pile			
a)Boring	hour	5.95	0.03
b)Clean up base	hour	0.57	0.01
c)Measuring, cutting & fabricate reinforcement cage	m/hour	3.13	0.03
d)Install reinforcement cage	m/hour	12.20	0.16
Pile Testing			
a)Set up	hour	14	2.67
b)Checking increment	hour	43.75	32.25
Excavation	m^3/hr	38.54	128.78
Formwork			
a)Size measurement, cutting & fabrication	m^2/hour	14.93	0.24
Reinforcement			
a)Size measurement, cutting & fabrication	ton/hour	0.59	0.003
Stump			
a)Installing formwork	m^2/hour	8.81	0.44
b)Concrete placement	m^3/hour	5.23	0.19
c)Dismantle Formwork	m^2/hour	16.37	1.92
Pile Cap			
a)Installing formwork	m^2/hour	5.35	0.88
b)Installing reinforcement	ton/hour	0.45	0.0004
c)Concrete Works	m^3/hour	8.76	0.11
d)Dismantle Formwork	m^2/hour	10.88	0.14

Ground Beam			
a)Installing formwork	m^3/hour	9.97	0.39
b)Installing reinforcement	m^2/hour	0.52	0.01
c)Concrete Placement	ton/hour	8.38	0.40
d)Dismantle Formwork	m^3/hour	20.75	1.41
Ground Slab			
a)Installing formwork	m^2/hour	15.00	0.34
b)Installing BRC	m^2/hour	17.00	0.25
c)Concrete Placement	m^3/hour	13.74	0.24
d)Dismantle Formwork	m^2/hour	22.08	1.82

Table 9 : Type of gang size subject to each activity

Activty/Task	Type of Gang Size	Number of workers
Piling Spun Pile		
a)Pile Driven	B	3-4
b)Average Depth	N/A	N/A
c)Pile Cutting	A	1-2
Piling Micro Pile		
a)Boring	B	3-4
b)Clean up base	B	3-4
c)Measuring, cutting & fabricate reinforcement cage	C	5-6
d)Install reinforcement cage	C	5-6
Pile Testing		
a)Set up	B	3-4
b)Checking increment	B	3-4
Excavation	A	1-2
Formwork		
a)Size measurement, cutting & fabrication	D	7-8
Reinforcement		
a)Size measurement, cutting & fabrication	D	7-8
Stump		
a)Installing formwork	B	3-4
b)Concrete placement	B	3-4
c)Dismantle Formwork	B	3-4

Pile Cap		
a)Installing formwork	D	7-8
b)Installing reinforcement	C	6-7
c)Concrete Works	B	3-4
d)Dismantle Formwork	C	5-6
Ground Beam		
a)Installing formwork	D	7-8
b)Installing reinforcement	D	7-8
c)Concrete Placement	C	5-6
d)Dismantle Formwork	B	3-4
Ground Slab		
a)Installing formwork	B	3-4
b)Installing BRC Mesh	B	3-4
c)Concrete Placement	D	7-8
d)Dismantle Formwork	B	3-4

Table 10 : Database of final production rates for substructure activities

Activty/Task	Unit	Production Rate
Piling Spun Pile : <u>Fine Grained Soil</u>	Bearing capacity : < 75 kN/m^2	
a)Pile Driven	m/hour	54.18
b)Average Depth	m	44.60
c)Pile Cutting	point/hour	6.67
Piling Spun Pile : <u>Coarse Grained Soil</u>	Bearing capacity : 75 to 150 kN/m^2	
a)Pile Driven	m/hour	19.17
b)Average Depth	m	17.77
c)Pile Cutting	point/hour	5.50
Piling Micro Pile		
a)Boring	hour	5.95
b)Clean up base	hour	0.57
c)Measuring, cutting & fabricate reinforcement cage	m/hour	3.13
d)Install reinforcement cage	m/hour	12.20
Pile Testing		
a)Set up	hour	14.00
b)Checking increment	hour	43.75
Excavation	m^3/hr	42
Formwork		
a)Size measurement, cutting & fabrication	m^2/hour	14.93

Reinforcement		
a)Size measurement, cutting & fabrication	ton/hour	0.59
Stump		
a)Installing formwork	m^2/hour	8.91
b)Concrete placement	m^3/hour	5.25
c)Dismantle Formwork	m^2/hour	16.69
Pile Cap		
a)Installing formwork	m^2/hour	5.24
b)Installing reinforcement	ton/hour	0.45
c)Concrete Works	m^3/hour	8.81
d)Dismantle Formwork	m^2/hour	10.82
Ground Beam		
a)Installing formwork	m^3/hour	10.06
b)Installing reinforcement	m^2/hour	0.54
c)Concrete Placement	ton/hour	8.56
d)Dismantle Formwork	m^3/hour	20.72
Ground Slab		
a)Installing formwork	m^2/hour	15.06
b)Installing BRC	m^2/hour	17.04
c)Concrete Placement	m^3/hour	13.68
d)Dismantle Formwork	m^2/hour	21.72

CHAPTER 5

DISCUSSION

5.1 CHALLENGES IN DIRECT OBSERVATION

The objective of this study are to collect data by direct observation and compile sets of "moderated" production rates database after finishing statistical analysis. Hence, the challenges may come during direct observation and also during compiling sets of data for production rates database. During conducting direct observation at several sites, it was realized that a lot of challenges may affect the progress of this research. External hindrances came from getting approval matters to enter sites, location of each site which is far away because they all located in different states and the last one is coordination matters with the contractor. Meanwhile, internal challenge came from the nature of conducting direct observation itself, especially for observing substructure activities. It took a lot of time to finish each cycle of substructure activities. Comparing to observing superstructure activity, the challenge is different because substructure activities is once-time-cycle. If the observation for certain activity has been finished, no repetition for that activity anymore.

5.2 FACTORS AFFECTING PRODUCTION RATES

During construction activity is done, there are a lot of factors that may affect their production rates. The major factor affecting production rates is number of gang size at site. To ensure the reliability of suggested database of production rates, the type of gang size with regard to its number of workers range also shown in the tabulated table.

The numbers of worker is given in gang size type because during observation, even though they did the same activity, but still there are slightly different numbers of worker at different site. But the difference is not more than 1 worker whether it is less or more. Due to that, the range of gang size number is 1 worker difference. Besides, there are also a few other factors that may affect production rates which are machinery capacity and site supervision. During direct observation was done for this research, all activities was performed under supervision.

5.3 LOW VARIANCE ANALYSIS

Most of the activity observed show low variance value. Meaning that the dispersion of the data is small and central tendency of the data is on *mean* value. At the end of this research, the database of production rates had been compiled based on this analysis. The production rates shown are reliable enough to be accepted as a database for future reference, after considering a few factors affecting the production rates and also based on statistical analysis.

In the early stage of doing statistics for the raw data, the variance value for spun pile type of "Pile Driven" activity, is also high which is *291.76.* Even though it has been categorized into its respective type of pile, but the value is still high. The reason contribute to the high variance value is because the type of the soil at 3 respective sites is different. If we refer to piling activity of spun pile type under "Pile Drive" production rates, it shows a big difference of production rates between Kota Bharu (Kelantan) site and Ipoh (Perak) site. Actually, the site at Kelantan has been built on fine grained soil whereas the site in Ipoh is piled on coarse grained soil. When piling is done on fine grained soil, the production rate will be much higher compare to coarse grained soil because fine grained soil has longer consolidation time. By classifying into type of soil, the production rate presented is more reliable to be referred.

However there is an activity that shows a large value of variance which is *128.78*. The reason of such variance is because different contractor use different bucket size of machinery (backhoe).

Other than that, all activities show low variance value. There are two factors contribute to the low variance values which are because collected raw data is obtained by direct observation and the second one is, the implementation of SPK-JKR quality standard under MS ISO 9001 that had been introduced by JKR. It is proven that, direct observation is the most appropriate method to develop a production rates database because compared to other method used to collect data such as questionnaire survey, it showed a large variance value. Besides, the quality standard of SPK, which had been set by JKR, also contributes to the low variance value. Every contractor must comply with the procedure and sequence of each activity in the SPK system. By simple words, it means if every contractor follows the standard and sequence in each activity, difference of production rates obtained, will not be so large.

After all, the analysis for direct observation method gives low variance value compared to survey method. Most of the variance analysis is below than 1 and not exceed 5.5 except for a few exempted activities. Compared to survey method, the variance value has reach up to thousands value. It is proven that from the variance analysis, the direct observation method is more reliable compared to survey method.

CHAPTER 6

ECONOMIC BENEFITS

6.1 COST

The nature of doing direct observation always related to lots of time consuming and also highly in cost, especially doing direct observation for construction works. But then, the method can give almost accurate data taken for research purpose. Most of the cost comes from accommodation fee for different places and also transportation expenditure (by car) to go to the site. The observation use work sampling method and takes a lot of time. Besides, the activities in construction work are interrelated and the observer needs to be at the site for each activity cycle. There is no accommodation expenditure for Ipoh site as the place is not too far from the author apartment. Due to that, the cost estimation spent for this research is tabulated in the table below.

Table 11 : Cost estimation subject to each location

	Kota Bharu	Ipoh	Petaling Jaya	Shah Alam
Accommodation	RM 720	-	RM 880	RM 880
Transportation	RM 560	RM 240	RM 560	RM 560
Toll	-	-	RM 300	RM 300
Total Cost	RM 5,000			

6.2 BUSINESS ELEMENT

For this research, the economic value is applied as part of business element because the database will be used in the construction industry. The database of production rate is beneficial for construction industry especially for contractor who needs to plan the best for their time scheduling for cost saving purpose. A lot of money can be saved which is good for parties involved in the business of construction. Besides, the contractor also can estimate their time based on production rate database obtain from this research. They can use the database as their benchmark to achieve excellent productivity in construction work. Any delay of certain activities can be prevented earlier by considering all the factors that contribute to the delay based on production rates database.

CHAPTER 7

CONCLUSION & RECOMMENDATION

7.1 CONCLUSION

Direct observation method used in collecting data for production rates is more appropriate compared to survey method especially to collect data in construction field. This statement is based on comparison between direct observation and survey method variance analysis as per discussed in Chapter 5. Strengthen with statistical analysis done, this research has meet all of its objectives and the production rates compiled can be used as for database of substructure activity. It is useful as a reference to academia and also can be used in industry field.

7.2 RECOMMENDATION

For optimal implementation of this research, there is some room for improvement to be made. First, the frequency of direct observation can be increased so that the data obtained will be more collectable than this. By doing so, the outcome of statistical analysis will lead to a better database of production rate.

The most challenging part about direct observation is it is very much time consuming. So, for further research towards the development of production rates database of civil works, it can be continued by PhD or Master student because they should have more time and focus, rather than limited time for those who pursuing Bachelor Degree.

Besides, there is a need to widen the scope of direct observation by collecting data for high rise building in future, so that the variability of the data can be compared with this research.

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APPENDIX A

GANNT CHART FOR FYP 1

No.	Detail/ Week	1	2	3	4	5	6	7		8	9	10	11	12	13	14
1	Selection of Project Topic	■	■													
2	Preliminary Research Work		■	■	■											
3	Submission of Preliminary Report				●											
4	Literature review					■	■	■								
5	Project Work					■	■	■								
6	Submission of Progress Report 1									●						
7	Submission of Progress Report 2										■	■	■	■		
8	Project work continues									■	■	■	■	■		
9	Submission of Interim Report Final Draft														●	
10	Oral Presentation															●

Mid-semester break

● Milestone

■ Process

APPENDIX B

GANNT CHART FOR FYP 2

No.	Detail/ Week	1	2	3	4	5	6	7		8	9	10	11	12	13	14
1	Project Work Continue	■	■	■												
2	Submission of Progress Report 1				●											
3	Project Work Continue				■	■	■	■								
4	Submission of Progress Report 2									●						
5	Meeting with Supervisor										■	■	■			
5	Project work continue									■	■	■	■			
6	Poster Exhibition											●				
7	Submission of Dissertation (soft bound)													●		
8	Oral Presentation														●	
9	Submission of Project Dissertation (Hard Bound)															●

Mid-Semester Break

● Suggested milestone

■ Process

APPENDIX C
PERMISSION LETTER

Pn. Siti Rohani
JKR Petaling.
Harap dapat bantu pelajar ini.

12/1/2010.

HABIBAH BINTI BABA
Pen. Pengarah Kanan Bangunan (P)
JKR Selangor
Shah Alam

Jabatan Kerja Raya Selangor,
Tingkat 1&2, Bangunan Sultan Salahuddin
Abdul Aziz Shah,
40582 Shah Alam,
Selangor Darul Ehsan.

06hb Januari 2010

U/p : En Muhammad Bin Adam
(Ketua Penolong Pengarah Bahagian Bangunan)

Tuan .

PER : MEMOHON KEBENARAN UNTUK MENDAPATKAN MAKLUMAT BAGI TUJUAN KAJI SELIDIK PEMBELAJARAN.

Adalah saya dengan hormatnya merujuk kepada perkara diatas,

Ingin dimaklumkan bahawa En Muhamad Nazim Mohamad Nawi dengan (K/P : 880329-29-5077 / No Matrik : 8350) adalah pelajar program Ijazah Kejuruteraan Awam di Jabatan Kejuruteraan Awam, Universiti Teknologi PETRONAS (UTP).

Untuk melengkapkan pengajian, beliau telah memilih untuk melaksanakan kajian kadar produktiviti di tapak bina.

Sehubungan dengan itu pihak Jabatan mengharapkan agar pihak tuan dapat membantu dengan memberikan kerjasama serta membekalkan maklumat yang diperlukan untuk kajian beliau.

Kami juga memberi jaminan bahawa segala maklumat yang diperolehi hanya terhad untuk tujuan kaji selidik pembelajaran dan bukannya untuk tujuan lain.

Segala perhatian dan kerjasama daripada pihak tuan amat kami hargai.

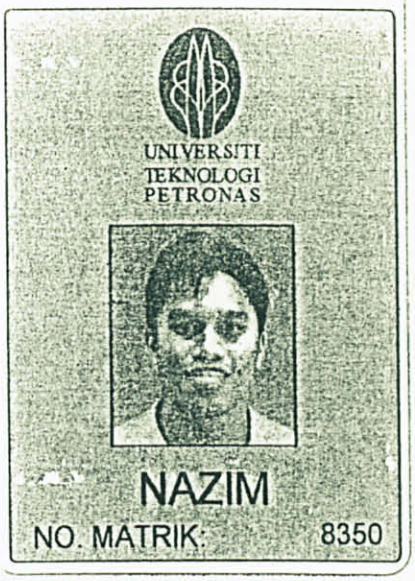
Yang benar,

.....

(Profesor Madya Ir. Dr. Arazi Bin Idrus)
b/p Ketua Kelompok Struktur Bahan dan Pembinaan
Jabatan Kejuruteraan Awam,
Universiti Teknologi PETRONAS (UTP).

s.k : Profesor Madya Dr. Shamsul Rahman Bin Mohamed Kutty,
(Ketua Jabatan, Kejuruteraan Awam UTP).

En Rahmi, Sila beri bantuan.
Farah → Sila selesai 24.
Azlin → Sila fail segera. 18/1.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Sah Sehingga : 16/11/2010
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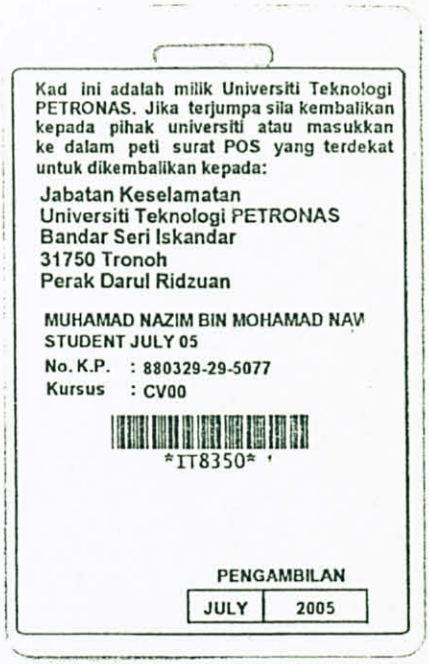

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Universiti Teknologi PETRONAS
Bandar Seri Iskandar
31750 Tronoh
Perak Darul Ridzuan

MUHAMAD NAZIM BIN MOHAMAD NAV
STUDENT JULY 05
No. K.P. : 880329-29-5077
Kursus : CV00

IT8350

PENGAMBILAN

JULY	2005

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2. Pemegang kad ini yang berumur di antara 16 hingga 65 tahun adalah diliindungi di bawah Skim Takaful Berkelompok yang berkuatkuasa sehingga tempoh kad ini tamat sahnya.
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Berdaftar Untuk Menjalankan Trad:

LLTOO CONSTRUCTION TRAINEE/STUDENT

KETUA EKSEKUTIF

Ibu Pejabat CIDB, Tingkat 7, Grand Seasons Avenue, No. 72 Jalan Pahang, 53000 Kuala Lumpur
http://www.cidb.gov.my Tel:03-2617 0200 / Fax:03-4043 0601

KETUA PENGARAH
PENDAFTARAN NEGARA
880329-29-5077-02

Touch 'n GO ATM 64K chip MEPS CASH

Muhamad Nazim Mohamad Nawi
Universiti Teknologi PETRONAS,
Bandar Seri Iskandar,
31750 Tronoh, Perak,
Malaysia.

Pengarah Projek,
D' Intan Rarmai Trade
Sdn Bhd
(u/p : Zulfikri Amin)

29hb SEPTEMBER 2009.

Tuan,

PEMBINAAN PEJABAT JABATAN AUDIT NEGARA CAWANGAN NEGERI KELANTAN

Permohonan Untuk Menjalankan kajian Di tapak Bina

Dengan segala hormatnya perkara di atas dirujuk.

Untuk makluman pihak tuan, saya adalah pelajar tahun akhir 'Bachelor in Civil Engineering' daripada Universiti Teknologi Petronas sedang menjalankan kajian yang bertajuk '*Development of Production Rate Database for Substructure Works by Direct Observation*'.

Sehubungan ini, saya ingin mendapatkan kebenaran daripada pihak tuan untuk membuat kajian di tapak bina yang sedang dijalankan oleh pihak tuan.Bersama-sama ini juga disertakan lampiran kad matrik dan kad hijau untuk rujukan pihak tuan.

Segala kerjasama dan sokongan pihak tuan untuk menjayakan kajian ini amat saya harapkan dan saya dahului dengan ucapan ribuan terima kasih.

Sekian.

Yang benar,

MUHAMAD NAZIM MOHAMAD NAWI

D' INTAN TRADE SDN. BHD.
(Company No: 561296-M)

ZULFIKRI AMIN B. ABDUL GHANI
JURUTERA PROJEK

Muhamad Nazim Mohamad Nawi
Universiti Teknologi PETRONAS,
Bandar Seri Iskandar,
31750 Tronoh, Perak,
Malaysia.

Pejabat Jurutera Jajahan,
JKR Jajahan Kota Bharu,
Jalan Kuala Krai,
15050 Kota Bharu, Kelantan.
(u/p : Alias Ab Kadir, Penolong Pengarah Kanan Bangunan) 23 September 2009.

Tuan,

PERMOHONAN UNTUK MENDAPATKAN MAKLUMAT PROJEK DAN MENJALANKAN KAJIAN DI TAPAK BINA DI NEGERI KELANTAN

Dengan segala hormatnya perkara di atas dirujuk.

Untuk makluman pihak tuan, saya adalah pelajar tahun akhir 'Bachelor in Civil Engineering' daripada Universiti Teknologi Petronas sedang menjalankan kajian yang bertajuk '*Development of Production Rate Database for Substructure Works by Direct Observation*'.

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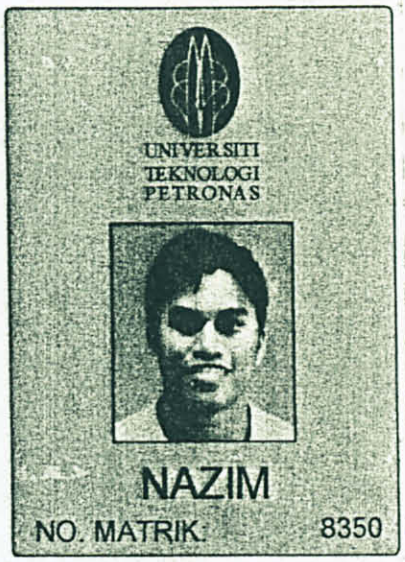
Sekian.

Yang benar,

Muhamad Nazim Mohamad Nawi

ALIAS BIN AB KADIR
Penolong Pengarah Kanan Bangunan
(Bangunan Am & Keselamatan)
JKR Kelantan



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Perak Darul Ridzuan

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STUDENT JULY 05
No. K.P. : 880329-29-5077
Kursus : CV00

IT8350

PENGAMBILAN

JULY	2005


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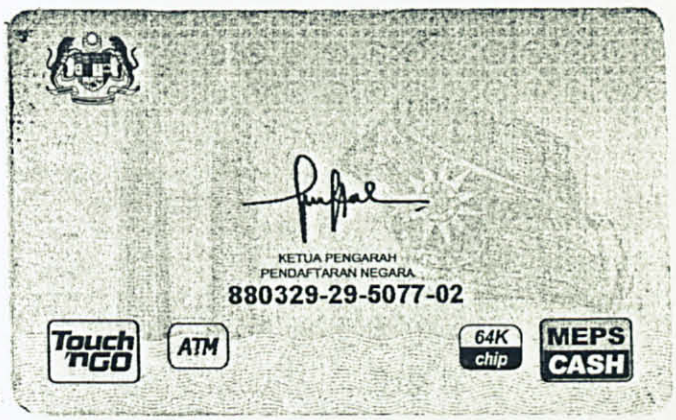
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Lembaga Pembangunan Industri Pembinaan Malaysia
CONSTRUCTION INDUSTRY DEVELOPMENT BOARD MALAYSIA

CIDB MALAYSIA

No. Kad : W81171120080104

MUHAMAD NAZIM BIN MOHAMAD NAWI

No. K.P./Pasport : 880329-29-5077
Sah Sehingga : 16/11/2010

Berdaftar Untuk Menjalankan Tred :

LL MYS LLT00

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LLT00 CONSTRUCTION TRAINEE/STUDENT

KETUA EKSEKUTIF

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http://www.cidb.gov.my Tel:03-2617 0200 / Fax:03-4043 0801

APPENDIX D

METHOD OF STATEMENT

KERJA CERUCUK GEREKAN

BORANG PEMERIKSAAN
KERJA CERUCUK GEREKAN
(PERINGKAT PENERIMAAN)

[Borang JKR.PK(O).04-SKC.AS.2A]

Nama Projek : CADANGAN PEMBINAAN INSTITUT PERUBATAN MOLEKUL (UMBI), HUKM

Lokasi : Blok 53

Rujukan Lukisan No JKR.CKASJ/UKM/B/22/02STR-FDN/01 Rujukan Spesifikasi : .....

Borang pemeriksaan ini perlu dirujuk bersama spesifikasi/dan lukisan projek.

Butiran Pemeriksaan	Standard/ Keperluan Teknikal	Pengukuran/ Penilaian* Tapak Oleh Kontraktor	Pengesahan JKR *	Catatan/ No. NCR
Bahagian I – Kelulusan bahan-bahan				
1. Kelulusan bahan-bahan -rujuk Borang JKR.PK(O).04-SKC.ST.1A (Kerja Struktur Konkrit – Peringkat Penerimaan)		✓	✓	
Bahagian II – Kelulusan loji/peralatan kerja di tapak		✓	✓	
1. Peralatan-peralatan untuk kerja konkrit yang disediakan untuk kegunaan di tapak		✓	✓	
2. Peralatan kerja-kerja penggerekan dan menuang konkrit		✓	✓	
2.1 Jentera Pengorek - *Crawler Crane (Grabmethod)* - *Rotary Drilling (Continuous Flight Auger, Twin Rotary Head)* - *Rock coring (chisel, Core-barrel, cross Head Cutter, Reamer* dan sebagainya		✓	✓	
2.2 Selongsong sementara *(Temporary casing)*		✓	✓	
2.3 Pengerudian cecair (Bertonit / penstabilan buburan yang lain)		✓	✓	
2.4 *Concrete Tremie Pipe* (untuk kerja konkrit di dalam air / lubang berair)		✓	✓	
2.5 *Hover* dengan pelonsong yang pendek (kaedah mencurah secara terus untuk lubang kering)		✓	✓	
3. Makmal tapak untuk pengujian (jika ada)		NA		
4. Loji pengelompokan konkrit yang diadakan di tapak		✓	✓	

Nota:	√	jika *mematuhi* spesifikasi /dan lukisan.
*Tandakan	x	jika *tidak mematuhi* spesifikasi /dan lukisan(rujuk borang NCR).

Diperiksa oleh,

7/10/09

.....

Wakil Kontraktor
Nama: AHMED EZMIN B. MOHD NORDIN
Jawatan: PENGURUS TAPAK
Tarikh:

Disemak oleh,

9/10/09

.....

PTB JKR
Nama: **RAJA MOHD ZAKRY**
Jawatan: **Inspector of Works**
Tarikh: **AZZAM CONSULT**

BORANG PEMERIKSAAN
KERJA CERUCUK GEREKAN
(SEMASA PEMBINAAN)

[Borang JKR.PK(O).04-SKC.AS.2B]

Nama Projek : CADANGAN PEMBINAAN INSTITUT PERUBATAN MOLEKUL (UMBI), HUKM

Lokasi : P29/53

Rujukan Lukisan No JKR.CKASJ/UKM/B/22/02STR-FDN/01 Rujukan Spesifikasi : .....

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Butiran Pemeriksaan	Standard/ Keperluan Teknikal	Pengukuran/ Penilaian* Tapak Oleh Kontraktor	Pengesahan JKR *	Catatan/ No. NCR
Pemeriksaan di tapak				
1. **Kerja permulaan;**				
1.1 *Method Statement.*		✓	✓	
1.2 Peralatan dan kelengkapan mengikut *method statement*		✓	✓	
2. **Kerja gerekan;**		✓	✓	
2.1. Kedudukan cerucuk		✓	✓	
2.2. Kaedah gerekan sebagaimana *method statement*		✓	✓	
2.3. Garispusat cerucuk.		✓	✓	
2.4. Cerun cerucuk sadak *(raked pile)*		NA		
2.5. Garispusat lubang gerek		✓	✓	
2.6. Kedalaman lubang gerek *(drilled holes)*		✓	✓	
2.7. Sisihan kedudukan akhir lubang cerucuk.	Tidah lebih 75mm	✓	✓	
2.8. Kepugakan lubang gerekan	Tidak lebih 1:150	✓	✓	
2.9. Kesetabilan lubang gerekan.				
2.10 Kelonsong keluli sementara dengan saiz dan panjang yang sesuai	minima 1m / di bawah strata yang tak stabil	✓	✓	
2.11 Keperluan penstabilan lubang gerekan dengan cecair pengerudi		✓	✓	
3 **Pengesahan Hamparan Batu** (jika berkenaan)		NA		
3.1 Pemeriksaan terhadap serpihan batu yang dikorek		NA		
3.2 Kedalaman diperolehi (banding dengan *borelog* dan semak dengan pita pengukur.		✓	✓	
3.3 Ujian kekuatan batu di tapak (*contoh: Point Load Test*)				

Nota:	√	jika ***mematuhi*** spesifikasi /dan lukisan.
*Tandakan	x	jika ***tidak mematuhi*** spesifikasi /dan lukisan(rujuk borang NCR).

Diperiksa oleh.

9/10/09

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Wakil Kontraktor

Nama: AHMED EZMIN B. MOHD NORDIN

Jawatan: PENGURUS TAPAK

Tarikh:

Disemak oleh.

9/10/09

.....

PTB JKR

Nama: RAJA MOHD ZAKRY

Jawatan: Inspector of Works

Tarikh: AZZAM CONSULT

BORANG PEMERIKSAAN
KERJA CERUCUK GEREKAN
(SEMASA PEMBINAAN)

[Borang JKR.PK(O).04-SKC.AS.2B]

Nama Projek : CADANGAN PEMBINAAN INSTITUT PERUBATAN MOLEKUL (UMBI), HUKM

Lokasi : P2a | 53

Rujukan Lukisan No JKR.CKASJ/UKM/B/22/02STR-FDN/01 Rujukan Spesifikasi : .....

Borang pemeriksaan ini perlu dirujuk bersama spesifikasi/dan lukisan projek.

Butiran Pemeriksaan	Standard/ Keperluan Teknikal	Pengukuran/ Penilaian* Tapak Oleh Kontraktor	Pengesahan JKR *	Catatan/ No. NCR
4. **Pembersihan dasar lubang/kaedah *airlifting***				
4.1 Pembersihan dasar lubang menggunakan *cleaning bucket* sebelum *airlifting* dijalankan		✓	✓	
4.2 Pembersihan dasar lubang menggunakan *airlifting*		NA		
5. **Besi tetulang *(reinforcement)***				
5.1 Jenis/ saiz/ panjang/ bentuk/ bilangan bar	12|25	✓	✓	
5.2 Pertindihan bar *(Lapping/ anchorage)*	40 D	✓	✓	
5.3 Penutup Konkrit *(cover/ spacer/ steel chairs)*	75mm	✓	✓	
5.4 Pengikatan bar (kedudukan yang betul, kemas dan kukuh)		✓	✓	
5.5 Ruang antara bar		✓	✓	
5.6 Panjang sangkar tetulang *(reinforcement cage)* sesuai dengan kedalaman korekan	25.075	✓	✓	
6. **Kerja konkrit**				
6.1 Tabung '*casing*' atau tabung sementara digunakan dengan betul & sempurna (dimana perlu)		✓	✓	
6.2 Penempatan konkrit ke dalam lubang gerekan dibuat dengan cara yang telah diluluskan		✓	✓	
i) Menuang (menggunakan *Tremie* untuk *Wet Hole Construction*) ii) Suntikan		✓	✓	
6.3 Pemandatan konkrit.		✓	✓	
6.4 Gred konkrit dan kandungan minima simen.		✓	✓	

Nota:	√	jika *mematuhi* spesifikasi /dan lukisan.
*Tandakan	x	jika *tidak mematuhi* spesifikasi /dan lukisan(rujuk borang NCR).

Diperiksa oleh,

7/10/09

.....

Wakil Kontraktor

Nama: AHMED EZMIN B. MOHD NORDIN

Jawatan: PENGURUS TAPAK

Tarikh:

Disemak oleh

9/10/09

.....

PTB JKR

Nama: RAJA MOHD ZAKRY

Jawatan: Inspector of Works

Tarikh: AZZAM CONSULT

BORANG PEMERIKSAAN KERJA CERUCUK GEREKAN (SEMASA PEMBINAAN)

[Borang JKR.PK(O).04-SKC.AS.2B]

Nama Projek : CADANGAN PEMBINAAN INSTITUT PERUBATAN MOLEKUL (UMBI), HUKM ..

Lokasi : P2A/53

Rujukan Lukisan No JKR.CKASJ/UKM/B/22/02STR-FDN/01 Rujukan Spesifikasi : .....

Borang pemeriksaan ini perlu dirujuk bersama spesifikasi/dan lukisan projek.

Butiran Pemeriksaan	Standard/ Keperluan Teknikal	Pengukuran/ Penilaian* Tapak Oleh Kontraktor	Pengesahan JKR *	Catatan/ No. NCR
6.5 Penuangan tanpa henti sehingga ke paras ditetapkan.	1m di atas aras pemotongan	✓	✓	
6.6 Hujung bawah *treime* sentiasa tenggelam (tidak ditarik naik secara mengejut)	1 – 2m di bawah aras konkrit	✓	✓	
6.7 Tempuh penyiapan kerja konkrit.	1 jam (tanpa retarder)	✓	✓	
7. **Ujian Konkrit**				
7.1 Ujian runtuhan konkrit *(slump test)*		✓	✓	
7.2 Ujian suhu		NA		
7.3 Ujian kiub		✓	✓	
7.4 Keputusan ujian kiub didaftar untuk analisa.		✓	✓	
7.5 Keputusan ujian kebolehtelapan *(permeability test)* untuk analisa.		NA		
8. Senarai data-data/rekod : 8.1 Lokasi cerucuk 8.2 Saiz ukuran cerucuk 8.3 Tarikh dibuat (tarikh konkrit) 8.4 Keadaan cerucuk 8.5 Rujukan cerucuk 8.6 Kedalaman cerucuk ditanam 8.7 Kedudukan, penyimpangan dan kecondongan cerucuk 8.8 Aras permotongan cerucuk 8.9 Aras formasi tanah		✓	✓	

Nota:	√	jika *mematuhi* spesifikasi /dan lukisan.
*Tandakan	x	jika *tidak mematuhi* spesifikasi /dan lukisan(rujuk borang NCR).

Diperiksa oleh:

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Wakil Kontraktor

Nama: AHMED EZMIN B. MOHD NORDIN

Jawatan: PENGURUS TAPAK

Tarikh:

Disemak oleh,

9/10/09

.....

PTB JKR

Nama: **RAJA MOHD ZAKRY**

Jawatan: **Inspector of Works**

Tarikh: **AZZAM CONSULT**

BORANG PEMERIKSAAN
KERJA CERUCUK GEREKAN
(PRODUK SIAP)

[Borang JKR.PK(O).04-SKC.AS.2C]

Nama Projek : CADANGAN PEMBINAAN INSTITUT PERUBATAN MOLEKUL (UMBI), HUKM

Lokasi : P29/53

Rujukan Lukisan No JKR.CKASJ/UKM/B/22/02STR-FDN/01 Rujukan Spesifikasi : .....

Borang pemeriksaan ini perlu dirujuk bersama spesifikasi/dan lukisan projek.

Butiran Pemeriksaan	Standard/ Keperluan Teknikal	Pengukuran/ Penilaian* Tapak Oleh Kontraktor	Pengesahan JKR *	Catatan/ No. NCR
Pemeriksaan produk yang disiapkan				
1. Tempuh masa minima pengawetan dicapai				
2. Keputusan ujian kiub (7 hari) diperolehi dan menepati spesifikasi				
3. Kemukakan cadangan pembaikan untuk kelulusan sekiranya terdapat kecacatan pada bahagian konkrit				
4. Semak integriti cerucuk gerekan mengunakan salah satu dari kaedah berikut jika perlu:- a) *Use High Strain Dynamic Load Test (HSDLT)* b) *Pile Integrity Test (PIT)* c) *Sonic Logging.*				
5. Bandingkan kedalaman cerucuk dengan *borelog*				
6. Senarai data-data/rekod: 6.1 Lokasi cerucuk 6.2 Saiz ukuran cerucuk 6.3 Tarikh dibuat (tarikh konkrit) 6.4 Keadaan cerucuk 6.5 Rujukan cerucuk 6.6 Kedalaman cerucuk ditanam 6.7 Kedudukan, penyimpangan dan kecondongan cerucuk 6.8 Aras permotongan cerucuk 6.9 Aras formasi tanah				

Nota:	√	jika *mematuhi* spesifikasi /dan lukisan.
*Tandakan	x	jika *tidak mematuhi* spesifikasi /dan lukisan(rujuk borang NCR).

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Wakil Kontraktor
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Jawatan:
Tarikh:

Disemak oleh,

.....
PTB JKR
Nama:
Jawatan:
Tarikh:

METHOD OF STATEMENT FOR TEST PILE

400mm Diameter Spun Pile
200mm X 200mm RC Square Pile

METHOD OF STATEMENT FOR TEST PILE

INTRODUCTION

This is a proposal of the load testing for JABATAN AUDIT NEGARA CAWANGAN KELANTAN – KERJA-KERJA BANGUNAN.

TEST PILE DESCRIPTION

The detail of the test pile is as follows:

Pile Type	:	Concrete Spun Pile and Reinforcement Concrete Square Pile
Pile Size / diameter	:	400mm Diameter Spun Pile & 200mm X 200mm RC
Working Load	:	750kN & 200kN
Maximum Test Load	:	1500 kN & 400kN

Test Pile (non-working Pile) : 400mm diameter Spun Pile

Test Load : 1875kN

TRIAL PILE AND TEST PILE

After the main piling operation completed, 2 nos (as directed by S.O.) selected pile will be load tested. The proposed location of the pile shall be shown in piling layout plan. Generally, it will be one static load test per block. The test load will be to the required load. The static or PDA test will be as directed by the S.O.

METHOD OF STATEMENT FOR TEST PILE

PREPARATION OF PILE HEAD

A mild steel plate with thickness not less then 10mm will be mounted on the top of the pile head to accommodate the loading and settlement measuring equipment and to prevent damage due to the concentrated of load from the loading equipment. The plane surface of the mild steel plate must be normal to the vertical axis of the pile, so that the test load will be distributed evenly to the test pile.

SETTLEMENT MESUREMENT

Four dial gauges will be equally spaced around the pile head and family held by magnetic base. Magnetic bases are attached to the hydraulic jack. (Refer Figure 1 &-2)

CRITERIA FOR LOAD TEST

The load test shall be considered as passed if the settlement is less than the following (or as per engineer requirement):-

a. Settlement at working load shall be less than 12.5mm.

b. Settlement at twice working load shall be less than as 38mm.

c. The residual settlement after unloading shall be less than as 6.30mm.

METHOD OF STATEMENT FOR TEST PILE

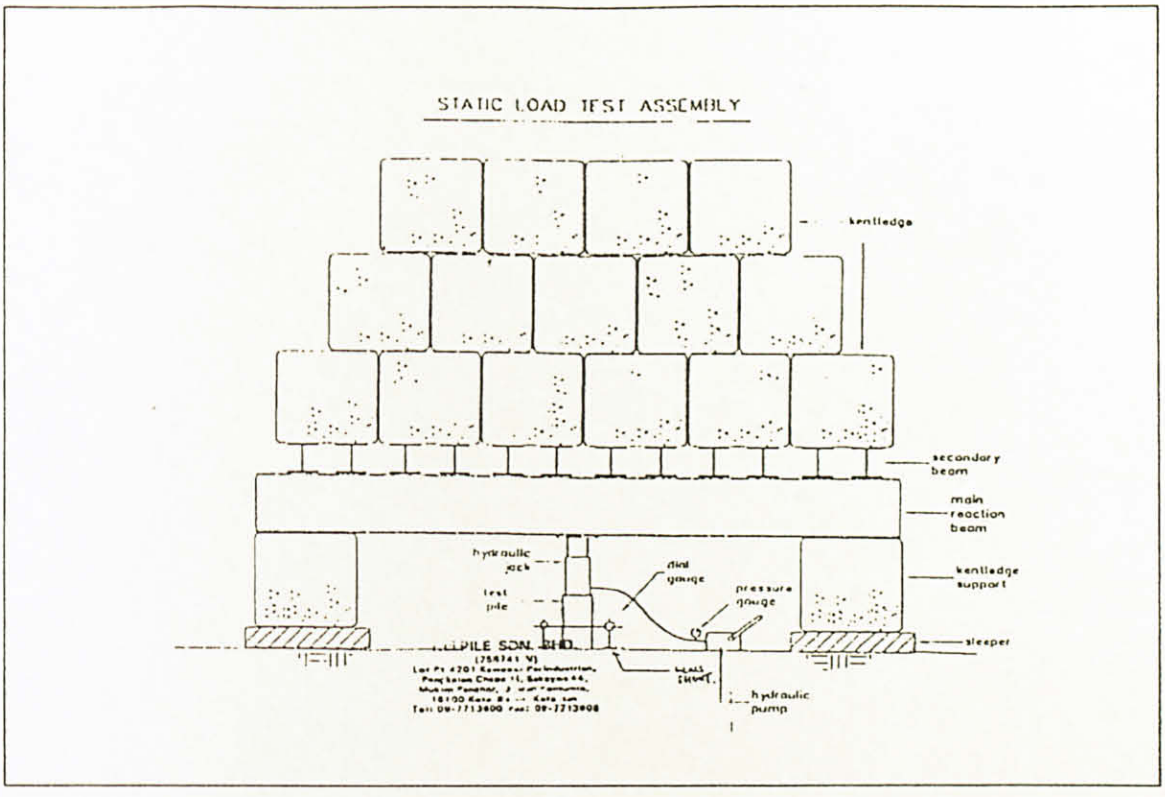

FIGURE 1

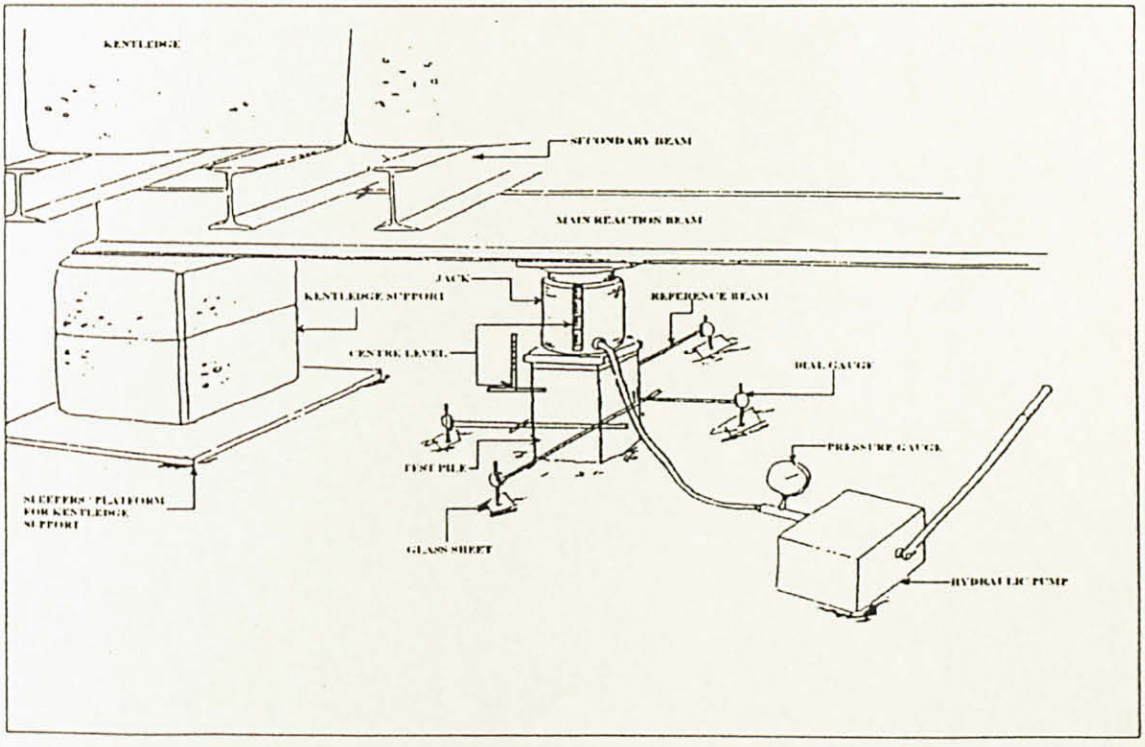

FIGURE 2

Freyssinet PSC (M) Sdn Bhd (9902-X)
9, Jalan 2/137B
Resource Industrial Centre
Off 5th Mile, Jalan Klang Lama
58000 Kuala Lumpur

Tel : 03-79828599 [8 Lines]
Fax : 03-79815530[GEN]03-79814803[TRDG]
Email : admin@fpscmalaysia.com

PRESSURE GAUGE INSPECTION REPORT

Customer :	*Kelpile Sdn Bhd*	Certificate Nº :	*P/2804/June/2009*
	Lot PT 4201, Kawasan	Date of Inspection :	*03.06.2009*
	Perindustrian Pengkalan Chepa	Gauge Nº :	*387*
	11, Sek. 44, Mukim Panchor	Gauge Capacity :	*10,000 psi*
	Daerah Kemumin	Graduation :	*100 psi*
	16100 Kota Bharu, Kelantan	Ram Diameter :	-
Standard :	*Superb-Barnet Dead Weight Tester SN: 7851*	Inspected By :	*Bachang*

Tester Applied Pressure [PSI]	Equivalent in [TONS]	Before Adjustment [PSI]	Reading After Adjustment		
			First Run [PSI]	Second Run [PSI]	Third Run [PSI]
500	-	300	500	500	500
1,000	-	800	1,000	1,000	1,000
2,000	-	1,800	2,000	2,000	2,000
3,000	-	2,800	3,000	3,000	3,000
4,000	-	3,800	4,000	4,000	4,000
5,000	-	4,800	5,000	5,000	5,000
6,000	-	5,800	6,000	6,000	6,000
7,000	-	6,800	7,000	7,000	7,000
8,000	-	7,800	8,000	8,000	8,000
9,000	-	8,800	9,000	9,000	9,000

Remarks:
.....
.....
.....
.....

Checked by : FREYSSINET PSC (M) SDN BHD

.....

Note:
- *Our Inspection Reports are issued in triplicate, all of which will bear the original signatures of our company's authorised report signatories.*
- *Checks of the authenticity of the reports may be made at the above phone or fax Nº, citting the certificate and Gauge Nº.*
- *Duplicate certificates are also available on request, for a nominal fee.*
- *We cannot bear any responsibility whatsoever, for the consequences of failing to verify the authenticity of these certificates.*

Freyssinet PSC [M] Sdn Bhd (9902-X)
9, Jalan 2/137B
Resource Industrial Centre
Off 5th Mile, Jalan Klang Lama
58000 Kuala Lumpur

Tel : 03-79828599 [8 Lines]
Fax : 03-79815530(GEN)/79814803(TRDG)
Email : admin@fpscmalaysia.com

DIAL GAUGE INSPECTION REPORT

Customer : *Kelpile Sdn Bhd*
Lot PT 4201, Kaw. Perindustrian
Pengkalan Chepa 11, Sek 44
Mukim Panchor, Daerah Kemumin
16100 Kota Bharu, Kelantan

Certificate Nº : *D/9056/February/2009*
Date of Inspection : *21.02.2009*
Gauge Nº : *JLW 504*
Maximum Travel : *50 mm*
Graduation : *0.01 mm*
Standard : *Mitutoyo Tester 170-102*
S/N 400532
Inspected By : *Jinggut ak Maluda*

Item	Dial Gauge Reading [mm]	Tester Micrometer Reading [mm]		
		First Run	Second Run	Third Run
1.	5.00	5.003	5.003	5.003
2.	10.00	9.997	9.997	9.997
3.	15.00	14.996	14.996	14.996
4.	20.00	19.992	19.993	19.993
5.	25.00	24.999	24.999	24.999
6.	30.00	29.996	29.996	29.996
7.	35.00	35.001	35.001	35.001
8.	40.00	39.997	39.998	39.998
9.	45.00	45.002	45.002	45.002
10.	50.00	49.999	49.999	49.999

Remarks:

Checked by : FREYSSINET PSC (M) SDN BHD

Notes:
- *Our Inspection Reports are issued in triplicate, all of which will bear the original signatures of our company's authorised report signatories.*
- *Checks of the authenticity of the reports may be made at the above phone or fax Nº, citing the Certificate and Gauge Nº.*
- *Duplicate certificates are also available on request, for a nominal fee.*
- *We cannot bear any responsibility whatsoever, for the consequences of failing to verify the authenticity of these certificates.*

Freyssinet PSC [M] Sdn Bhd (9902-X)
9, Jalan 2/137B
Resource Industrial Centre
Off 5th Mile, Jalan Klang Lama
58000 Kuala Lumpur

Tel : 03-79828599 [8 Lines]
Fax : 03-79815530[GEN]/79814803[TRDG]
Email : admin@fpscmalaysia.com

DIAL GAUGE INSPECTION REPORT

Customer : *Kelpile Sdn Bhd*
Lot PT 4201, Kaw. Perindustrian
Pengkalan Chepa 11, Mukim
Panchor, Daerah Kemumin
16100 Kota Bharu, Kelantan

Certificate N° : *D/9059/February/2009*
Date of Inspection : *21.02.2009*
Gauge N° : *JPJ 759*
Maximum Travel : *50 mm*
Graduation : *0.01 mm*
Standard : *Mitutoyo Tester 170-102*
S/N 400532
Inspected By : *Jinggut ak Maluda*

Item	Dial Gauge Reading [mm]	Tester Micrometer Reading [mm]		
		First Run	Second Run	Third Run
1.	5.00	4.997	4.997	4.997
2.	10.00	10.000	9.999	9.999
3.	15.00	14.996	14.996	14.996
4.	20.00	19.997	19.997	19.997
5.	25.00	24.996	24.996	24.996
6.	30.00	29.998	29.998	29.998
7.	35.00	34.997	34.997	34.997
8.	40.00	39.999	39.999	39.999
9.	45.00	44.997	44.998	44.998
10.	50.00	49.999	49.999	49.999

Remarks:

Checked by : FREYSSINET PSC (M) SDN BHD

Notes:
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Freyssinet PSC [M] Sdn Bhd (9902-X)
9, Jalan 2/137B
Resource Industrial Centre
Off 5th Mile, Jalan Klang Lama
58000 Kuala Lumpur

Tel : 03-79828599 [8 Lines]
Fax : 03-79815530[GEN]/79814803[TRDG]
Email : admin@fpscmalaysia.com

DIAL GAUGE INSPECTION REPORT

Customer : Kelpile Sdn Bhd
Lot PT 4201, Kaw. Perindustrian
Pengkalan Chepa 11, Sek 44
Mukim Panchor, Daerah Kemumin
16100 Kota Bharu, Kelantan

Certificate Nº : D/9057/February/2009
Date of Inspection : 21.02.2009
Gauge Nº : JPJ 757
Maximum Travel : 50 mm
Graduation : 0.01 mm
Standard : Mitutoyo Tester 170-102
S/N 400532
Inspected By : Jinggut ak Maluda

Item	Dial Gauge Reading [mm]	Tester Micrometer Reading [mm]		
		First Run	Second Run	Third Run
1.	5.00	4.999	4.999	4.999
2.	10.00	10.001	10.000	10.000
3.	15.00	14.998	14.998	14.998
4.	20.00	19.999	19.999	19.999
5.	25.00	24.996	24.996	24.996
6.	30.00	29.998	29.998	29.998
7.	35.00	34.997	34.997	34.997
8.	40.00	39.999	39.999	39.999
9.	45.00	44.996	44.997	44.996
10.	50.00	49.997	49.997	49.997

Remarks:

Checked by : FREYSSINET PSC (M) SDN BHD

Notes:
- Our Inspection Reports are issued in triplicate, all of which will bear the original signatures of our company's authorised report signatories.
- Checks of the authenticity of the reports may be made at the above phone or fax Nº, citing the Certificate and Gauge Nº.
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JK

Freyssinet PSC [M] Sdn Bhd (9902-X)
9, Jalan 2/137B
Resource Industrial Centre
Off 5th Mile, Jalan Klang Lama
58000 Kuala Lumpur

Tel : 03-79828599 [8 Lines]
Fax : 03-79815530[GEN]/79814803[TRDG]
Email : admin@fpscmalaysia.com

DIAL GAUGE INSPECTION REPORT

Customer : *Kelpile Sdn Bhd*
Lot PT 4201, Kaw. Perindustrian
Pengkalan Chepa 11, Sek 44
Mukim Panchor, Daerah Kemumin
16100 Kota Bharu, Kelantan

Certificate Nº : *D/9058/February/2009*
Date of Inspection : *21.02.2009*
Gauge Nº : *JLW 557*
Maximum Travel : *50 mm*
Graduation : *0.01 mm*
Standard : *Mitutoyo Tester 170-102*
S/N 400532
Inspected By : *Jinggut ak Maluda*

Item	Dial Gauge Reading [mm]	Tester Micrometer Reading [mm]		
		First Run	Second Run	Third Run
1.	5.00	4.998	4.998	4.998
2.	10.00	9.998	9.998	9.998
3.	15.00	14.996	14.996	14.996
4.	20.00	19.997	19.997	19.997
5.	25.00	24.995	24.995	24.995
6.	30.00	29.998	29.997	29.997
7.	35.00	34.996	34.996	34.996
8.	40.00	39.998	39.998	39.998
9.	45.00	44.995	44.995	44.995
10.	50.00	49.996	49.996	49.996

Remarks:

Checked by : FREYSSINET PSC (M) SDN BHD

Notes:
- *Our Inspection Reports are issued in triplicate, all of which will bear the original signatures of our company's authorised report signatories.*
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- *We cannot bear any responsibility whatsoever, for the consequences of failing to verify the authenticity of these certificates.*

JK

D'INTAN TRADE SDN. BHD.
LOT 2152-A JALAN TOK KENALI,
WAKAF STAN, KUBANG KERIAN,
16150 KOTA BHARU, KELANTAN.
TEL 09 -764 3500 FAX: 09-764 6500

DOCUMENT TRANSMITTAL FORM

Project	PEMBINAAN PEJABAT JABATAN AUDIT NEGARA CAWANGAN NEGERI KELANTAN - KERJA-KERJA BANGUNAN		
To	PERUNDING FND ATTN : IR. MOHD AFENDI B. MOHD ZAIN		
Date	28HB JULAI 2009	Issued Reference No.	
Reference No.	DTSB/PJANK/DT/006	Issued Date	
Subject	METHOD STATEMENT FOR PILING WORKS		

Sukacita dimajukan bersama-sama ini *Method statement* untuk *Load Test*. Dokumen adalah seperti berikut;

i) Test Pile Procedure and PSI Conversion
ii) Method of statement for test pile
iii) Pressure Gauge Inspection Report (Gauge No. 387)
iv) Dial Gauge Inspection Report (Gauge No JLW 504)
v) Dial Gauge Inspection Report (Gauge No JLW 557)
vi) Dial Gauge Inspection Report (Gauge No JLW 757)
vii) Dial Gauge Inspection Report (Gauge No JLW 759)

THANK YOU

☐ For Information ☐ As Required ☑ For Your Review ☐ For Sign & Return

	Name	Organisation	Signature & date
Issued By	Zulkifli Mohammad	D'INTAN TRADE SDN.BHD	28/7/0
Authorised By			
Aknowledgement			

Perunding FND

KELPILE SDN BHD (258741-V) KSB/OP/44-1

TEST PILE PROCEDURE AND PSI CONVERSION

PROJECT : PEMBINAAN PEJABAT JABATAN AUDIT NEGARA CAWANGAN NEGERI KELANTAN

CONTRACTOR : D' INTAN TRADE SDN BHD

CYLINDER POWER TEAM : 200 TONNE

CYLINDER EFECTIVE AREA : 5524.82 in²

LOAD OF TEST : 187.5 TONNE

FROM CALCULATION : 1 TONNE = 53 PSI

JACK	NO	TONNE	PSI	
LOAD	1	23.44	1242.19	
LOAD	2	46.88	2484.38	
LOAD	3	70.31	3726.56	
LOAD	4	93.75	4968.75	
LOAD	5	117.19	6210.94	
LOAD	6	140.63	7453.13	
LOAD	7	164.06	8695.31	
LOAD	8	187.50	9937.50	(Maintain 24 Hours)
UNLOAD	1	140.63	7453.13	
UNLOAD	2	93.75	4968.75	
UNLOAD	3	46.88	2484.38	
UNLOAD	4	0.00	0.00	

Jack	8 Times	16 HOURS
READINGS ARE TAKEN EVERY		15 MINUTES
MAINTAIN		24 HOURS
REALEASE	4 Times	8HOURS

JACK 200 TONS

Eff Area $= \frac{\pi \quad d^2}{4}$

$= \frac{3.142 \times (7.25 \times 7.25)\ In^2}{4}$

$= \frac{165.1514}{4}\ In^2$

$= 41.28784\ In^2$

When the pressure gauge is pointed at 1000psi the loading is

$=$ Presure x Eff. Area

$=$ 1000psi x 41.28784 In^2

$=$ 41287.84 lbs

to tons $= \frac{41287.84\ lbs}{2204\ lbs}$

$=$ 18.7331 tons

18.7331 tons $=$ 1000 psi

1 tons $=$ 53.381 psi

1 tons $=$ 53 psi

18.73 Tonne	=	1000 psi
37.47 Tonne	=	2000 psi
56.20 Tonne	=	3000 psi
74.93 Tonne	=	4000 psi
93.67 Tonne	=	5000 psi
112.40 Tonne	=	6000 psi
131.13 Tonne	=	7000 psi
149.86 Tonne	=	8000 psi
168.60 Tonne	=	9000 psi
187.33 Tonne	=	10000 psi

CSC BG

Borneo Geotechnic
Sdn Bhd (Co. No. 357536-A)

METHOD STATEMENT
FOR
BORED PILE CONSTRUCTION

BORNEO GEOTECHNIC SDN BHD
22-3, Jalan PJU 8/5B
Damansara Perdana
47820 Petaling Jaya
Tel : +6 03 7710 6266
Fax: +6 03 7710 7266
e-mail : bg@borneogeotechnic.com.my

CSC A member of CSC Holdings Limited

METHOD STATEMENT FOR CONSTRUCTION OF BORED PILE

Table of Contents

METHOD STATEMENT FOR CONSTRUCTION OF WORKING PILE

A. Formation of Borehole

1. Set out pile position

Pile positions will be set out by a Total Station Surveying Instrument and check by a supervisory office before commencement of piling.

2. Set boring unit

Prior to boring, the surveyed pile position will be offset in two perpendicular directions as a counter checking points during installation and construction procedure.

3. Commence boring with boring unit

During the course of boring, the following checks will be made:

- Check the position of the pile centre at necessary depth;
- Check the verticality of the casing during installation, using a spirit level and plumblines
- If the borehole is stable with little or no side collapse, the boring continues to the final predetermined founding level.

4. On encountering an unstable stratum

If an unstable stratum is encountered during boring, or if the borehole begins to collapse, a temporary casing will be installed to a predetermined depth. If necessary, when the casing cannot penetrate further, a vibro hammer will be used to drive the casing.

5. Continue boring with a soil auger or soil bucket

6. On encountering an unstable stratum below the casing depth

If an unstable stratum is encountered below the casing depth, one of the following methods will be used to stabilise the borehole :

- Extend and further install the casing to prevent collapse

- Using water or polymer or bentonite as the stabilising fluid, if necessary.

7. Completion of boring

Boring will cease when the agreed pile toe level has been reached. During the boring operation, samples will be taken at 1.5m interval or as directed. These samples will be properly labelled and submitted to the Consultant's site staff.

8. Cleaning of base

The base of the borehole will be cleaned with a cleaning bucket to the satisfaction of the supervisory site staff.

9. Boring through rock

Should bedrock be encountered at the base of the borehole, a combination of the following will be used:

- Chisel
- Coring bucket
- Rock Auger
- Grab

The change of rock tools is expected when the natural material encountered has an SPT N-Value $\geq$ 200 blows per 300mm and this material is classified as rock.

I. Coring Bucket or Rock Auger with the tungsten carbide bullet teeth are used for coring into rock. In more difficult type of rocks, Roller Bits are used in place or in combination with the tungsten carbide teeth. For larger diameter, a two stage coring is carried by a smaller Coring Bucket and followed by the bigger one. The two stage method is also used in very hard rock.

II. A Grab may be used to extract fractured rocks or smaller boulders.

III. A Chisel is used with combination of the Coring Bucket, if necessary

IV. A Coring Bucket will also be used to core the base of the borehole at the final level.

V. The base of the borehole will then be cleaned using a cleaning bucket.

B. Installation of Reinforcement Cage

1. Prior to concrete placement

Prior to the placing of concrete, the approved steel reinforcing cage will be lowered into the borehole to the correct level. Correct positioning of the cage within the borehole will be ensured by the use of concrete spacers, properly provided to achieve the necessary concrete cover of 50mm or 75mm or as specified.

2. Welding of links

Several links at the top and bottom of the steel cage will be welded to provide rigidity, and hanging supports will be welded to the main steel at the top of the cage to facilitate lifting.

3. Concrete spacers

Circular concrete spacers will be used, constructed of the same grade of concrete as the pile, to provide the cover. The spacers will either be threaded onto the links or be part of the links. The links supporting spacers will be welded onto the main reinforcement bars.

C. Concreting

1. "Dryhole"

I. In the event of an essentially "dry" borehole, ready-mixed concrete will be discharged directly into the hole from a hopper with the discharge pipe (similar to tremie pipes) to the bottom of the borehole.

II. Concrete will be cast above the cutoff level for at least 0.5 m.

III. If there is an installed temporary casing, this casing will be withdrawn, with a vibro hammer if necessary.

On completion of concreting, due care will be shown in extracting the casing by means of vibro hammer. The empty bore is backfilled to the top with soil.

D. Concrete Cube Test

Concrete test cubes aré taken and tested for 7days and 28days cube strength for quality control at the rate of 6 cubes for every twenty cubic meter of concrete used. For larger bored pile whose volume is greater than twenty cubic meter, 6 cubes per bored pile. Three cubes are tested for 7days and 28days strength each.

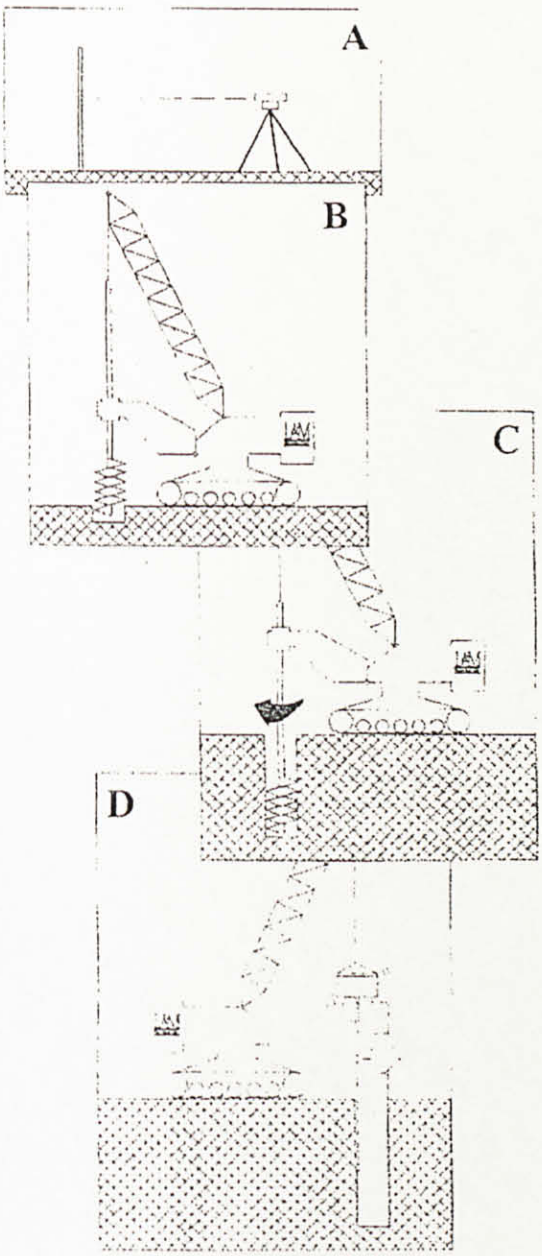
E. Bored Pile Record

Upon completion of the construction of the bored pile, the Bored Pile Record is completely filled and submitted to the Supervisory Staff or Engineer's Representative for verification and certification

APPENDIX A

Procedure For Installation Of A Bored Pile

PROCEDURE FOR INSTALLATION OF A BORED PILE



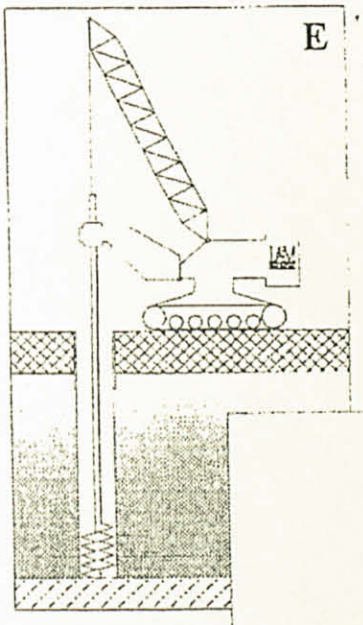
A) SETTING-OUT OF THE EXACT LOCATION OF THE PILE

B) A FLIGHT AUGER MOUNTED ON A BORING RIG INITIATES THE EXCAVATION

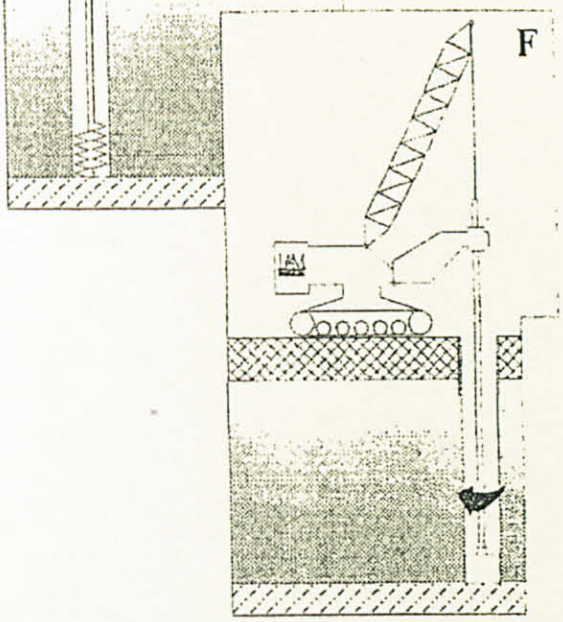
C) THE OPERATION PROCEEDS

D) A TEMPORARY CASING IS INSERTED IF THE SOIL SHOWS SIGNS OF COLLAPSE

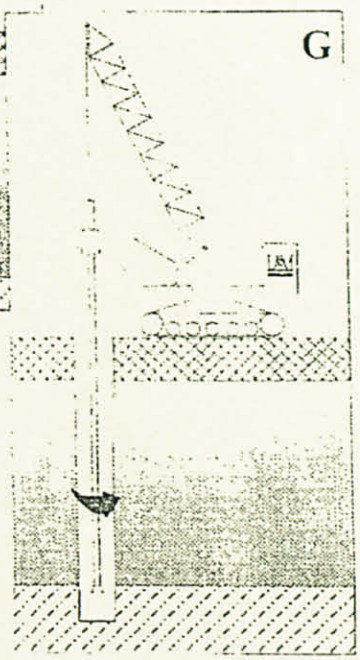
PROCEDURE FOR INSTALLATION OF A BORED PILE (CONTINUED)



E&F) BORING CONTINUES WITH AUGER OR BORING BUCKET, DEPENDING ON THE CONSISTENCY OF THE SOIL, UNTIL THE DESIGN DEPTH IS REACHED

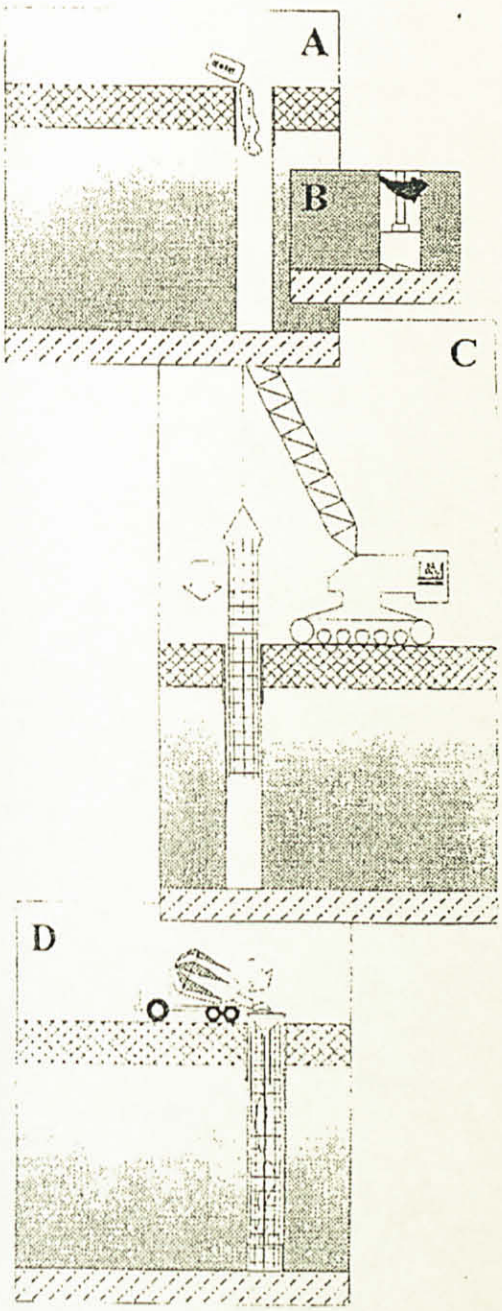


G) THE NEXT STEP IS TO CLEAN UP THE BASE WITH A CLEANING BUCKET



CONCRETING PROCEDURE UNDER 'DRY HOLE' CONDITIONS

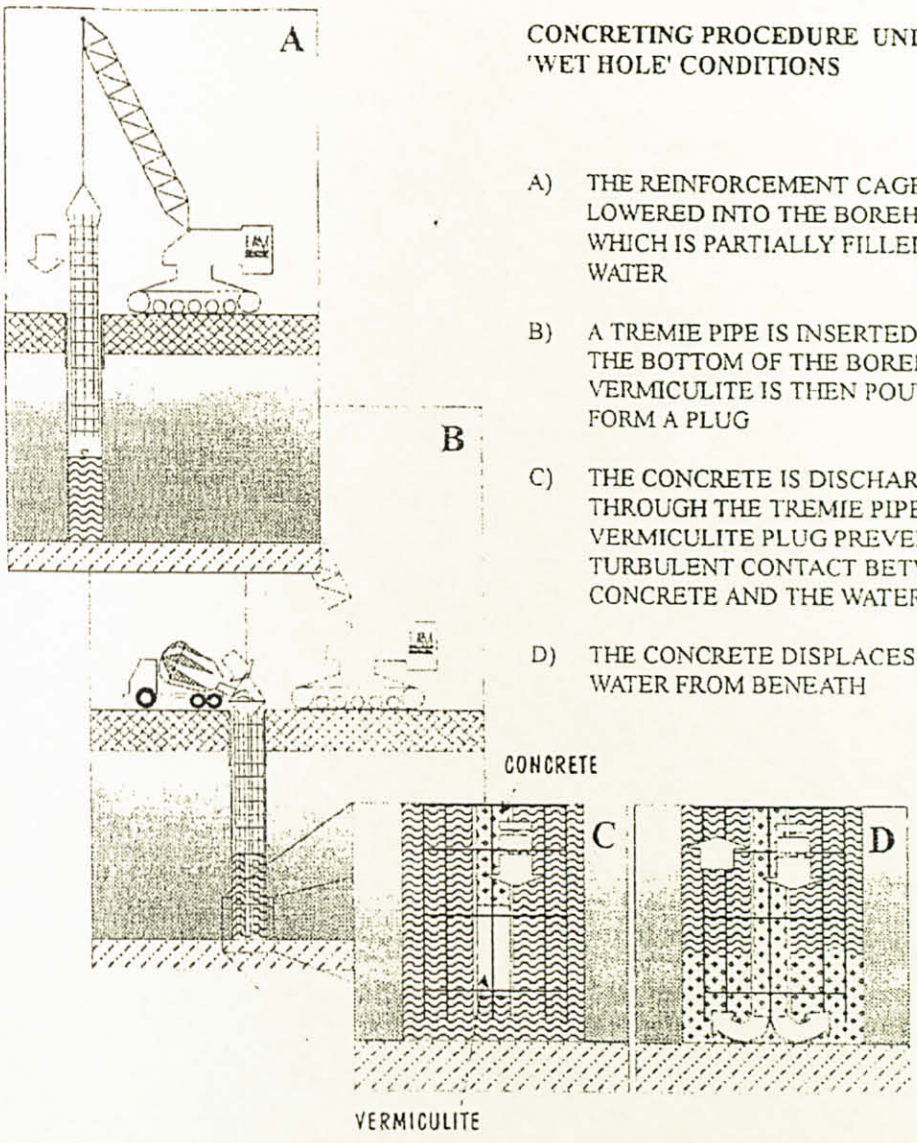
(NOTE: THIS OPERATION IS ADOPTED WHEN THE PILE BORE IS DRY OR WHEN IT CONTAINS A FEW CENTIMETRES OF WATER)



A&B) WHEN A FEW CENTIMETRES OF WATER IS PRESENT IN THE BOREHOLE, A BAG OF CEMENT IS USUALLY DEPOSITED. THEN THE BASE IS CLEANED, USING A WASH BUCKET

C) THE REINFORCEMENT CAGE IS LOWERED

D) CONCRETE IS DISCHARGED DIRECTLY THROUGH A SHORT LENGTH OF PIPE ATTACHED TO A HOPPER



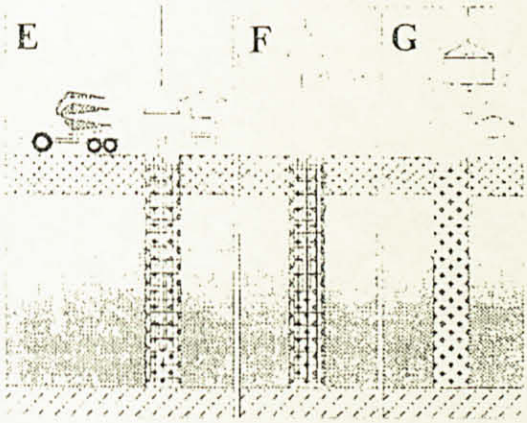
CONCRETING PROCEDURE UNDER 'WET HOLE' CONDITIONS

A) THE REINFORCEMENT CAGE IS LOWERED INTO THE BOREHOLE, WHICH IS PARTIALLY FILLED WITH WATER

B) A TREMIE PIPE IS INSERTED DOWN TO THE BOTTOM OF THE BOREHOLE VERMICULITE IS THEN POURED IN TO FORM A PLUG

C) THE CONCRETE IS DISCHARGED THROUGH THE TREMIE PIPE. THE VERMICULITE PLUG PREVENTS A TURBULENT CONTACT BETWEEN THE CONCRETE AND THE WATER

D) THE CONCRETE DISPLACES THE WATER FROM BENEATH



E) AS CONCRETING PROCEEDS, THE PIPE IS GRADUALLY WITHDRAWN. CARE IS TAKEN TO ENSURE THAT THE END OF THE PIPE IS EMBEDDED WITHIN THE BODY OF THE CONCRETE

F) WHEN THE REQUIRED LEVEL OF CONCRETE HAS BEEN POURED, THE PIPE IS TAKEN OUT

G) THE TEMPORARY CASING IS THEN WITHDRAWN

APPENDIX B

Proposed Recording Format

BG Borneo Geotechnic Sdn Bhd (Co No. 563564)

BORED PILE RECORD

Date : _____

PROJECT :	
CLIENT :	

PILE REF NO		BORE LOG	
PILE SIZE	mm	LENGTH (M)	SOIL DESCRIPTION
WORKING LOAD	mm		

BORING	
Working Platform Level	m
Cut-Off Level	m
Penetration From GL	m
Pile Length	m
Boring Commencement Time	am/pm
Boring Completion Time	am/pm
Temp / Perm Casing Length	m

BORED PILE DETAIL	
Reinforcement : No./Dia.	/ mm
Length	m
Links	
Concreting Method	DRY/TREMIE
Concrete Grade	25 / 30 / 35 / 40
Concreting Commencement Time	am/pm
Concreting Completion Time	am/pm
Theoritical Concrete Qty	m3
Actual Concrete Qty Used	m3
Concrete Supplier	

REMARKS:

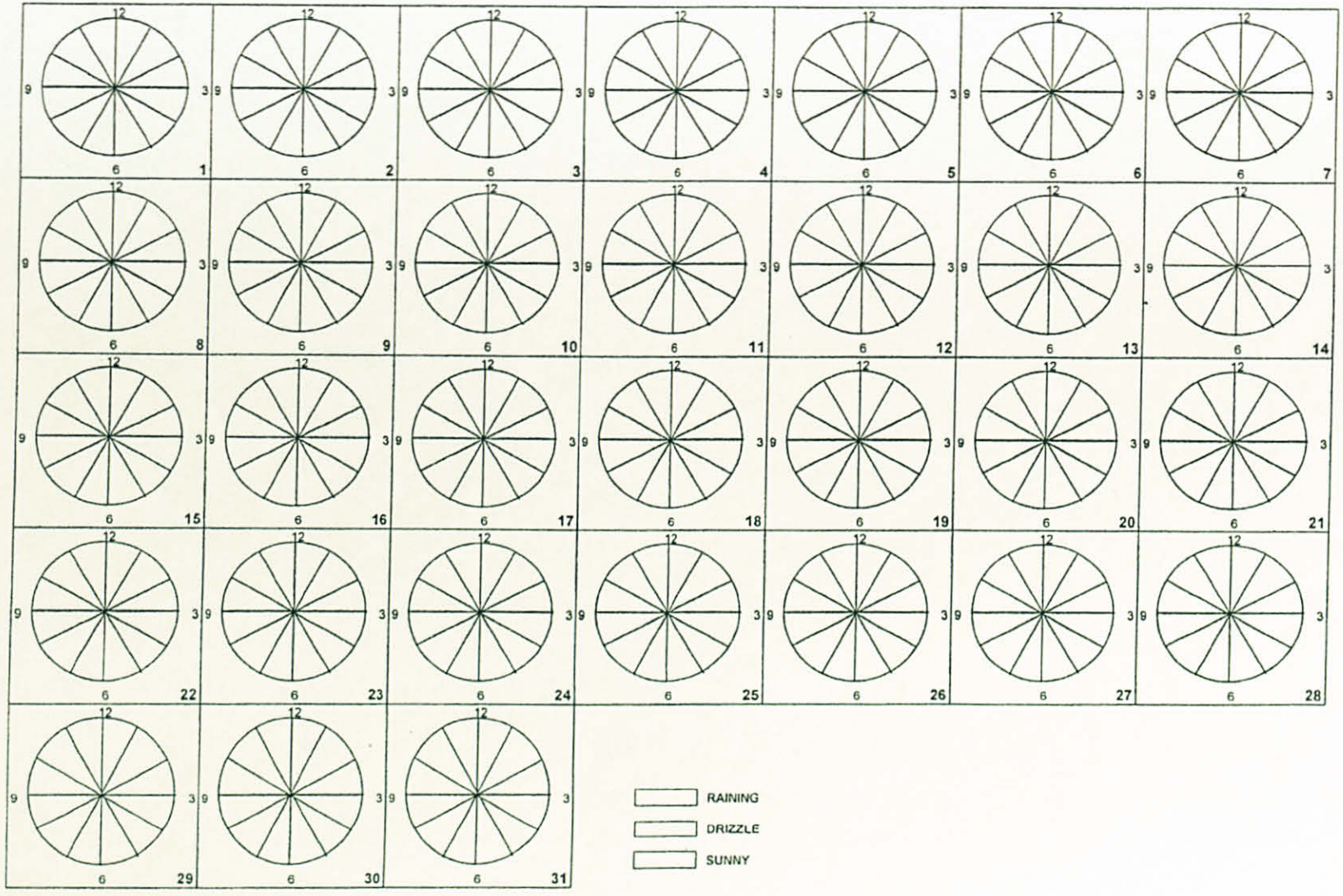
Prepared	Verified	Approved
Date/Name/Signature	Date/Name/Signature	Date/Name/Signature
Borneo Geotechnic Sdn Bhd		Client Representative

BG

WEATHER CHART

PROJECT : PJD REGENCY K3 ON LOT PT 15230, SRI HARTAMAS, KUALA LUMPUR.

MONTH: _____ YEAR: _____



BG Borneo Geotechnic Sdn Bhd (Co No. 557536-A)

DAILY REPORT

PROJECT _____

DATE _____

W/HOURS _____

WEATHER _____

O/TIME _____

MATERIAL

Casing		Diesel	
Steel Cage		Auger Teeth	
Oxygen		Welding Rod	
Acetylene			

MANPOWER

Engineer	
Supervisor	
Foreman	
Operator	
Welder	
Fabricator	
Direct Worker	
Supplied Worker	
Others	

EQUIPMENT

Crane		Vibrohammer	
Boring Rig		Bulidozer	
Welding Set			

DESCRIPTION OF WORK DONE

Pile Diameter										Total
Pile Required										
Pile Installed										
Pile Balance										

1- PROGRESS:

2- FACTOR AFECTING THE PROGRESS :

3- SITE INSTRUCTION / VARIATION :

4- REMARK :

Recorded by:

Verified by :

Borneo Geotechnic Sdn Bhd

Client Representative

BG Borneo Geotechnic Sdn Bhd (Co. No: 557536-A)

No: BG/

SITE MEMORANDUM

To	Project / Subject
From:	Date:

Regarding:-

- ❑ A verbal instruction given by.....on.....
- ❑ A written instruction ref.....dated.....
- ❑ Your transmittal/letter ref.....dated.....
- ❑ Copy/copies of drawing(s) nos.....dated.....
- ❑ A copy of your letter addressed to.....dated.....
- ❑ A copy of letter addressed to you from.....dated.....
- ❑ Record of a meeting at.....dated.....

FOR OFFICE USE ONLY

PLEASE BE ADVISED THAT THE ABOVE ITEM NO_____

- ❑ Would involve variation of ❑ Addition or of ❑ omission
- ❑ Would require additional time for completion.
- ❑ Would require further description/detail/drawing.

SMART DRILL ENGINEERING SDN BHD (639130-X)
MICRO PILE RECORD

PROJECT : SJK (T) VIVEKANANDA, PETALING JAYA, SELANGOR

CONTRACT NO : .....

LOCATION :

SUPERVISOR/ENGINEER: MOHD HAFIFI BIN MAMAT

PILE NO. : 2-E

NOMINAL DIAMETER (mm) : 300

GROUND LEVEL (m) : .....

PILE CUT-OFF LEVEL (m) : .....

DATE/TIME STARTED : 12/01/2010

DATE/TIME COMPLETED : 13/01/2010

TYPE of RIG: ROTOMAX

OPERATOR : ABDUL AZIZ

TYPE of BIT (DIA) : TUNGSTEN ROLLER BIT (300mm Diameter)

METHOD of DRILLING : ROTARY POLYMERIC MUD (Drilling Fluid)

BORING IN SOIL (m)

From 0.0 to 18.0 *(Sand/Soil)*

From ..... to .....

From ..... to .....

...18.0...(m)

DRILLING IN HARD STRATA/ROCK (m)

From 18.0... to 26.0... *(Hard Layer)*

From ..... to .....

From ..... to .....

.....8.0...(m)

TOTAL DEPTH DRILLED (m) :- 26.0

REINFORCEMENT BAR-CAGED DETAILS:-

1. NO. OF BARS :- 4 T 32
2. SPIRAL LINKS :- R8 150mm
3. LAPPING :- 2 x 1.3m

REINF. BAR-CAGED DEPTH INSTALLED (m) :- 29.4

PERMANENT CASING (m). IF ANY :- .....

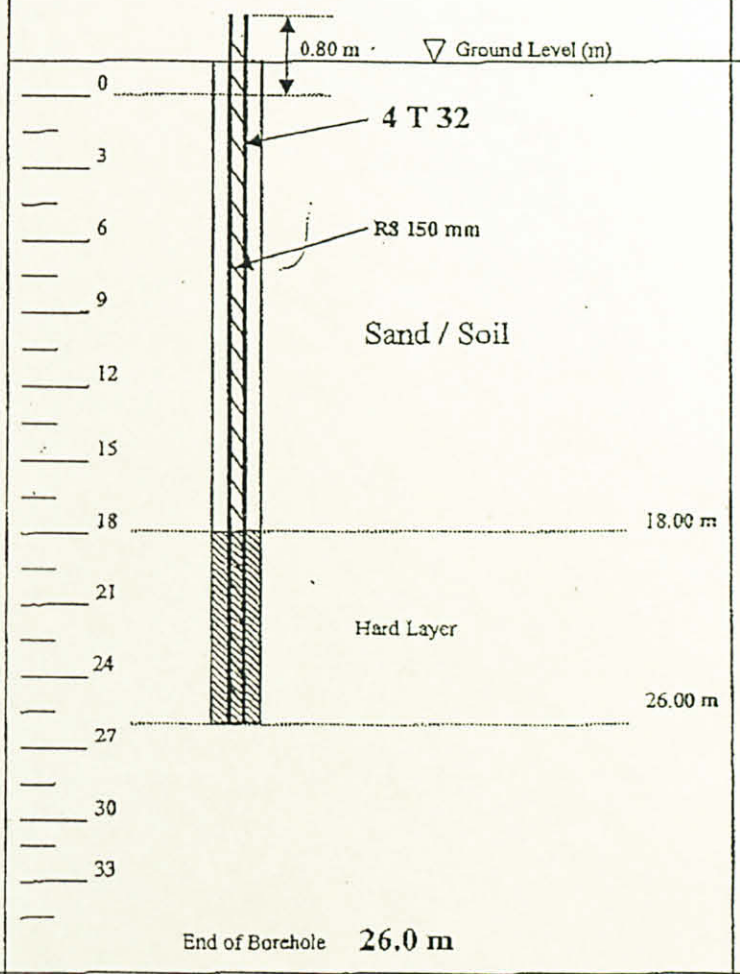
DATE OF GROUTING : 12/01/2010

GROUT MIX RATIO : 0.45

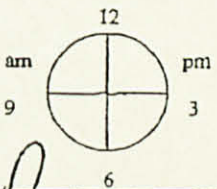
GROUT DESIGN STRENGTH (N/mm²) :- G – 30

ADDITIVE USED : SIKA INTRAPLAST-Z

CEMENT USED (Bags) : 65 bags



REMARKS:



Daily Weather

Rain
Drizzle
Cloudy
Clear

Recorded by:	Witness by:	Approved by:
SDE S/B	EP System Sdn Bhd	Consultant Representative
Date : 13/01/10	Date :	Date :

M. VIVEKANANTHAM
Juruteknik
JKR PETALING

SUMMARY OF RESULT

Pile Size = 300mm Dia. Micro Pile
Test Load = 140 Ton

	PERCENT (%)	LOAD (TON)	SETTLEMENT (MM)	MAINTAIN (HOURS)
LOADING	0	0	0	0
	25	17.5	0.8300	1
	50	35.0	1.8700	1
	75	52.5	2.7975	1
	100	70.0	4.0925	1
	125	87.5	5.5275	1
	150	105.0	7.1850	1
	175	122.5	8.7575	1
	200	140.0	11.5150	25
UNLOADING	150	105.0	11.2175	1
	100	70.0	9.7450	1
	50	35.0	7.1575	1
	0	0.0	3.3525	1
			Total Hours	36

KSP TEST PILE (M) SDN. BHD.
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Ref :

TEST LOADING OF PILE

Sheet No. : (1)

Project : membina dan menyiapkan 1 bangunan 4 tingkat SSK (T) UNICANANDA petaling Jaya, Selangor

Length Driven : 26 m

Type of Pile : micro pile

Contract :

Final Set :

Contractor :

Date of Driven : 12/01/2010

Location of Pile (Ref. Drg. No.) : 2-E

Date of Test : 01/02/2010

Test Pile No. : 1

Hydraulic Hand Pump (Model) : P462

Hydraulic Cylinder (Model) : CLS 2506

Pressure Gauge : 11327

Please collect the piling record

Dial Gauge No. : A YK173 / B AQB483 / C AQB437 / D CAN

Date	Time	Loading In Tons / PSI	Gauge Reading In ~~Inches~~ / mm A	B	C	D	TBM	~~JACK~~	JACK GYL	~~JACK~~	Average Pen / Set (In ~~Inches~~ / mm	Difference
09/01	3.00	0 T	5.00	5.00	5.00	5.00	70.0		70.0		5.00	0
(pm)	3.01	17.5T	4.84	5.09	7.48	5.79	70.0		71.5		5.80	0.80
	15	679.17	4.84	5.09	7.53	5.83					5.8225	0.8225
	3.30	psi	4.84	5.09	7.55	5.84					5.83	0.83
	45		4.84	5.09	7.55	5.84					5.83	0.83
	4.00		4.84	5.09	7.55	5.84	70.0		71.5		5.83	0.83
	4.01	35T	5.32	5.74	9.19	6.82	70.0		73.0		6.7675	1.7675
	15	1358.35	5.33	5.74	9.23	6.85					6.7875	1.7875
	4.30	psi	5.36	5.84	9.35	6.91					6.865	1.865
	45		5.36	5.84	9.35	6.91					6.865	1.865
	5.00		5.36	5.85	9.36	6.91	70.0		73.0		6.87	1.87
	5.01	52.5T	6.17	6.68	10.44	7.72	70.0		74.0		7.7525	2.7525
	15	2037.53	6.19	6.71	10.50	7.75					7.7875	2.7875
	5.30	psi	6.19	6.71	10.51	7.76					7.7925	2.7925
	45		6.19	6.72	10.51	7.76					7.7975	2.7975
	6.00		6.20	6.72	10.51	7.76	70.0		74.0		7.7975	2.7975
	6.01	70.T	7.47	7.98	11.78	8.88	70.0		75.0		9.0275	~~4.02~~
	15	2716.7	7.53	8.05	11.84	8.92					9.085	4.085
	6.30	ps	7.55	8.06	11.84	8.92					9.0925	4.0925
	45		7.55	8.06	11.84	8.92					9.0925	4.0925
	7.00		7.55	8.06	11.84	8.92	70.0		75.0		9.0925	4.0925
	7.01	87.5T	8.85	9.37	13.24	10.18	70.0		76.0		10.41	5.41
	15	3395.875	8.99	9.42	13.36	10.26					10.4925	5.4925
	7.30	psi	8.96	9.44	13.39	10.28					10.5175	5.5175

Checked by : 1/3/2010

Entries made by :

KSP TEST PILE (M) SDN. BHD.

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Email : ksptest@yahoo.com.my

Ref :

TEST LOADING OF PILE

Sheet No. : 2

Project : PEMBINAAN DAN MENYIAPKAN 1 BANGUNAN 4 TINGKAT SJK(C) VIVEKANANDA PETALING JAYA SELANGOR DE

Contract :

Contractor :

Location of Pile (Ref. Drg. No.) :

Test Pile No. : 1

Hydraulic Cylinder (Model) : CLS-250C

Please collect the piling record

Length Driven :

Type of Pile : Micro pile

Final Set :

Date of Driven :

Date of Test : 03/02/01

Hydraulic Hand Pump (Model) : P-462/ENERPAC

Pressure Gauge : 11324

Dial Gauge No. : (A) YB173/(B) A08483/(C) A08477/(D) AC348

Date	Time	Loading In Tons / PSI	Gauge Reading In Inches / mm A	B	C	D	TBM	JACK	JACK	JACK	Average Pen / Set (In Inches) / mm	Difference
03/01	7.45		8.96	9.45	13.40	10.30					10.5275	5.5275
(AM)	8.00		8.96	9.45	13.40	10.30	70.0		76.0		10.5275	5.5275
	8.01	105T	10.45	10.89	15.02	11.76	70.0		79.0		12.03	7.03
	15	4675.85	10.57	10.97	15.15	11.89					12.145	7.145
	8.30	(psi)	10.59	10.97	15.19	11.92					12.1675	7.1675
	45		10.60	10.98	15.20	11.94					12.18	7.18
	9.00		10.60	10.98	15.21	11.95	70.0		79.0		12.185	7.185
	9.01	122.57	11.86	12.26	16.70	13.29	70.0		80.0		13.5275	8.5275
	15	4754.25	12.06	12.40	16.87	13.44					13.6925	8.6925
	9.30	(psi)	12.08	12.43	16.89	13.46					13.715	8.715
	45		12.11	12.46	16.92	13.49					13.745	8.745
	10.00		12.12	12.47	16.94	13.50	70.0		80.0		13.7575	8.7575
	10.01	140T	13.71	13.95	18.67	15.15	70.0		82.0		15.37	10.37
	15	5433.4	13.94	14.15	18.88	15.35					15.58	10.58
	10.30	psi	13.96	14.16	18.93	15.37					15.605	10.605
	45		13.99	14.17	18.99	15.41					15.64	10.64
(Sustained 4 Hrs)	11.00		14.02	14.20	19.03	15.44	70.0		82.0		15.6725	10.6725
03/01	12.00		14.05	14.23	19.08	15.50	"		"		15.715	10.715
(AM)	1.00		14.08	14.27	19.14	15.55	"		"		15.76	10.76
	2.00		14.10	14.31	19.16	15.59	"		"		15.79	10.79
	3.00		14.15	14.33	19.21	15.62	"		"		15.8275	10.8275
	4.00	Jack	14.34	14.54	19.50	15.88	"		"		16.065	11.065
	5.00		14.44	14.64	19.61	15.98	"		"		16.1675	11.1675
	6.00		14.49	14.68	19.65	16.04	"		83.0		16.215	11.215
	7.00		14.50	14.68	19.66	16.05	"		"		16.2225	11.2225
	8.00		14.62	14.71	19.71	16.08	"		"		16.255	11.255

Checked by : 1/3/2010

Entries made by :

KSP TEST PILE (M) SDN. BHD.

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Email : ksptest@yahoo.com.my

Ref :

TEST LOADING OF PILE

Sheet No. : (3)

Project : MENDIRIA DAN MENJALANKAN PEMBUNAAN & TINGKAT CJK (TAMIL) VIVEKANANDA PETALING JAYA SELANGOR D.E

Contract :

Contractor :

Location of Pile (Ref. Drg. No.) :

Test Pile No. : (1)

Hydraulic Cylinder (Model) : CLS-250.6

*Please collect the piling record

Length Driven :

Type of Pile : Micro pile

Final Set :

Date of Driven :

Date of Test 01-03-2010

Hydraulic Hand Pump (Model) : P-462-ENERPAC

Pressure Gauge : 11324

Dial Gauge No. CYK173/A03483/A04437/447714 (A) (B) (C) (D)

Date	Time	Loading In Tons / PSI	Gauge Reading In Inches / mm A	B	C	D	TBM	JACK	JACK CYL	JACK	Average Pen / Set (In Inches) / mm	Difference mm
2/03/01	9 00	140T	14.74	14.73	19.73	16.10	70.0		83.0		16.275	11.275
(AM)	10 00	5775.4	14.56	14.75	19.75	16.13	"		"		16.2975	11.2975
	11 00	(PSI)	14.60	14.79	19.78	16.16	"		"		16.3325	11.3325
(PM)	12 00		14.65	14.86	19.88	16.26	"		"		16.4125	11.4125
	1 00		14.65	14.87	19.88	16.26	"		"		16.415	11.415
	2 00		14.68	14.91	19.92	16.29	"		83.5		16.45	11.45
	3 00		14.70	14.93	19.94	16.31	"		"		16.47	11.47
	4 00		14.73	14.96	19.98	16.33	"		"		16.47	11.47
	5 00		14.73	14.96	19.98	16.33	"		"		16.47	11.47
	6 00		14.73	14.96	19.98	16.33	"		"		16.47	11.47
	7 00		14.73	14.96	19.99	16.34	70.0		83.5		16.505	11.505
	8 00		14.74	14.97	20.00	16.35	"		"		16.515	11.515
	9 00		14.74	14.97	20.0	16.35	"		"		16.515	11.515
	10 00		14.74	14.97	20.0	16.35	"		"		16.515	11.515
	11.00		14.74	14.97	20.0	16.35	70.0		83.5		16.515	11.515
m	11.01	105 Ton	14.39	14.76	19.76	16.01	70.0		83.0		16.23	11.23
	15	4075.05	14.38	14.75	19.75	16.00					16.22	11.22
	30	PSI	14.38	14.75	19.75	16.00					16.22	11.22
	45		14.38	14.75	19.75	15.99					16.2175	11.2175
Am	12.00		14.38	14.75	19.75	15.99	70.0		83.0		16.2175	11.2175
03/10	12.01	75 Ton	12.83	13.32	18.30	14.56	70.0		81.0		14.7525	9.7525
Am	15	2716.7	12.82	13.32	18.30	14.55					14.7475	9.7475
	30	PSI	12.82	13.32	18.30	14.55					14.7475	9.7475
	45		12.82	13.32	18.29	14.56					14.745	9.745
	1.00		12.82	13.32	18.29	14.55	70.0		81.0		14.745	9.745

Checked by : 2/3/2010

Entries made by :

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(Company No : 567563-D)
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Tel : 03-3342 7567 , 03-3342 8567 Fax: 03-3344 9827
Email : ksptest@yahoo.com.my

Ref :

TEST LOADING OF PILE

Sheet No. : 4

Project : .....
.....
Contract : .....
Contractor : .....
Location of Pile (Ref. Drg. No.) : .....
Test Pile No. : T1
Hydraulic Cylinder (Model) : CLS-250C
Please collect the piling record

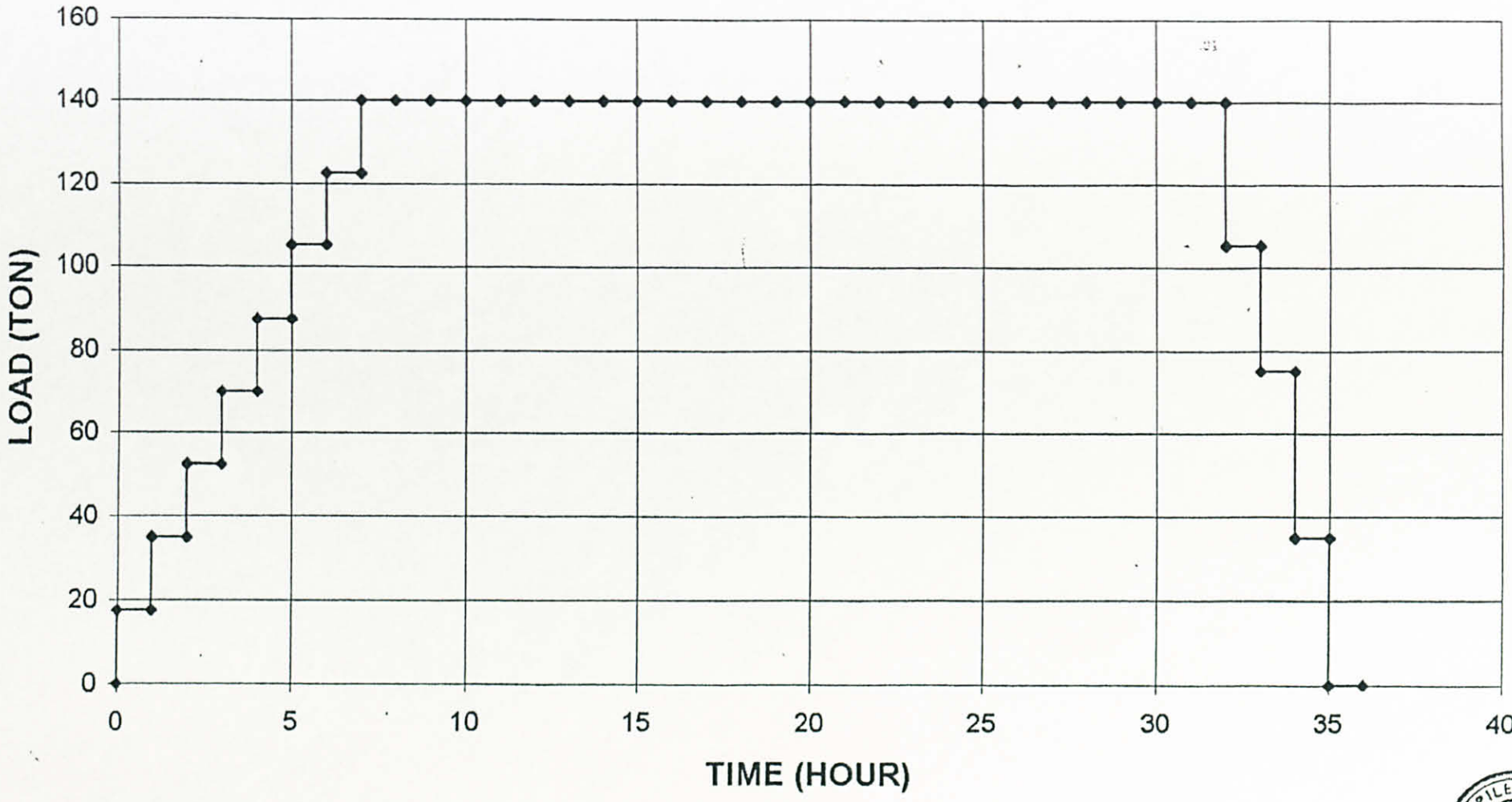
Length Driven : .....
Type of Pile : Micro pile
Final Set : .....
Date of Driven : .....
Date of Test : 01-03-2010
Hydraulic Hand Pump (Model) : P-462 - ENERPAC
Pressure Gauge : 11324
Dial Gauge No. CYK173/020483/A04237/CYK177

Date	Time	Loading In Tons / PSI	Gauge Reading In Inches / mm A	B	C	D	TBM	JACK	JACK (B)	JACK (C)	Average Pen / Set (In Inches) / mm	Difference mm (D)
0m	1.01	35 Ton	10.14	10.76	15.57	12.21	70.0		78.5		12.17	7.17
13/02/01	15	1358.35	10.14	10.76	15.57	12.19	〃		〃		12.165	7.165
(Am)	30	PSI	10.14	10.76	15.57	12.19	〃		〃		12.165	7.165
	45		10.14	10.75	15.56	12.19	〃		〃		12.165	7.165
	2.00		10.14	10.75	15.56	12.18	70.0		78.5		12.1575	7.1575
	2.01	0 Ton	7.31	8.00	10.10	9.48	70.0		74.0		8.7225	3.7225
	15	0 PSI	7.30	7.60	9.91	9.28	〃		〃		8.5225	3.5225
	0.30		7.23	7.56	9.83	9.22	〃		〃		8.46	3.46
	45		7.18	7.47	9.76	9.17	70.0		73.5		8.395	3.395
	3.08		7.14	7.43	9.71	9.13	70.0		73.5		8.3525	3.3525

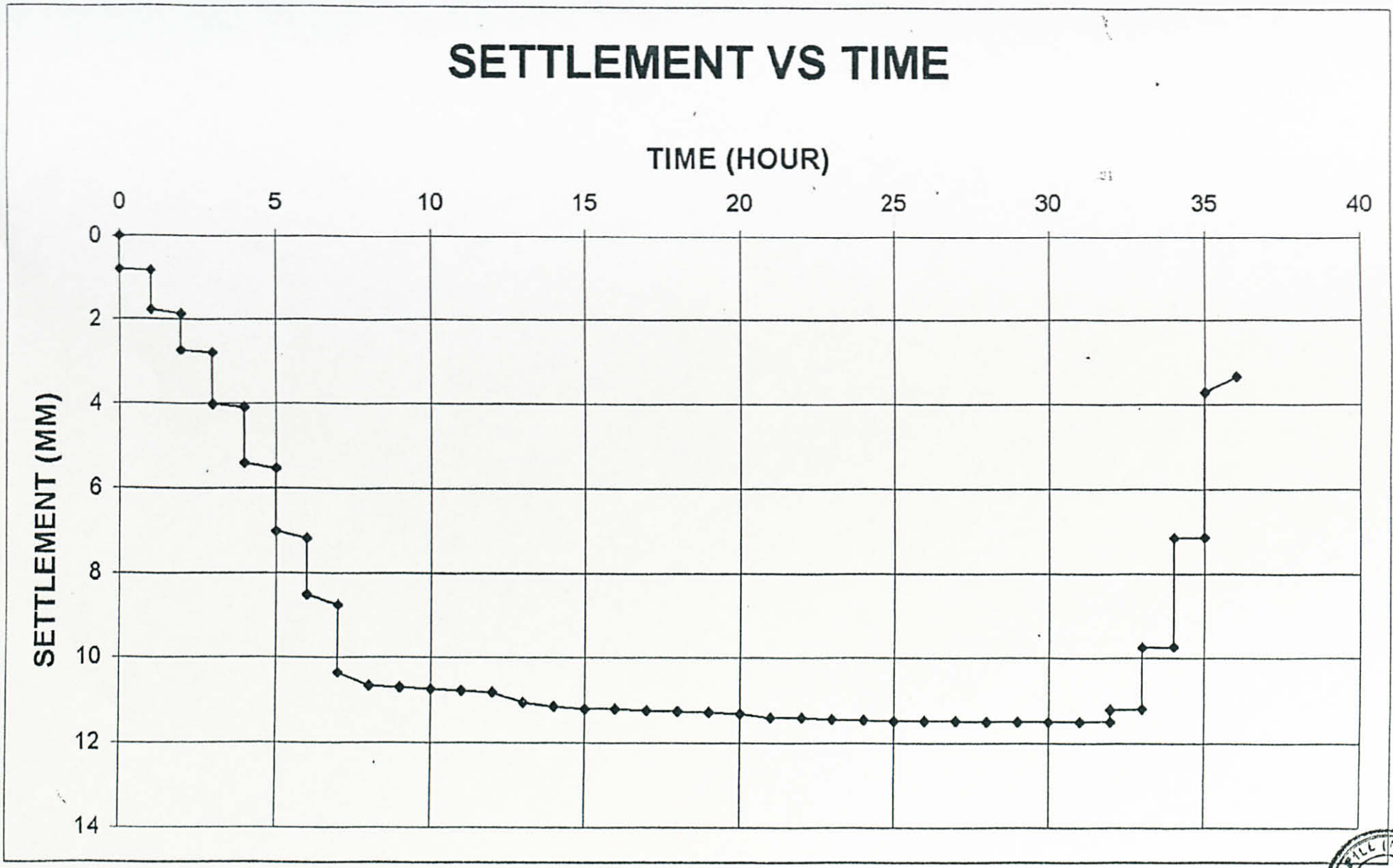
Checked by : [signature] 3/3/2010

Entries made by : [signature]

LOAD VS TIME



SETTLEMENT VS TIME



SETTLEMENT VS LOAD